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ORIGINAL ARTICLES

A STUDY OF BONE AND TOOTH CHANGES INCIDENT TO EXPERIMENTAL TOOTH MOVEMENT AND ITS APPLICATION TO ORTHODONTIC PRACTICE*†‡

SUMMARY TO DATE OF THE RESEARCH CONDUCTED UNDER GRANTS FROM THE AMERICAN SOCIETY OF ORTHODONTISTS AND THE BOARD OF RESEARCH OF THE UNIVERSITY OF CALIFORNIA

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INTRODUCTION AND HISTORICAL ASPECT OF THE PRESENT RESEARCH

ALTHOUGH a few references occur in the literature previous to 1929 on the subject of radicular resorption of permanent teeth, no exhaustive study was commenced until A. H. Ketcham reviewed roentgenographs taken from 385 cases. This was reported at the first International Orthodontic Congress at New York City, August, 1926. It attracted, at once, the attention of orthodontists throughout the world, and his combined roentgenographic and clinical observations were subjected to a searching scrutiny. Two facts became at once apparent: First, teeth which have undergone orthodontic treatment may show later, by roentgenographic examination, a decided shortening of the root length. Second, teeth which have *never* been subjected to this type of treatment show identical evidence of shortened roots. Several causes responsible for this condition were suggested: first, that local irritation of an undetermined character was so severe that resorptive processes were stimulated; second, that shortened roots might be connected, indirectly, with nutritional disturbances associated with various dietary factors. It was proposed that research work be undertaken to determine, if possible, what

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†For that portion of this report dealing with the calcification of teeth of macacus rhesus, acknowledgements are made to the Carnegie Institute of Washington, Department of Embryology, the Laboratory of Dr. Carl Hartman at Baltimore, Md., and to the Zoological Society of Philadelphia, the Laboratory of Dr. Herbert Fox. The roentgenographic study was carried out by the author in these two institutions.

‡Read at the Thirty-First Annual Meeting of the American Society of Orthodontists, Toronto, Canada, May 18-20, 1932.

local and general factors are concerned in the etiology of resorbed roots of uninfected permanent teeth. Dr. Ketcham and others invited me to cooperate in this research and suggested that I offer them a budget of yearly operating expense. Although I was engaged at the time in a research fostered by the American Dental Association and the Board of Research of the University of California, I felt, for many reasons, that this problem was closely associated with the one on which I had been working, namely the dietary factors in the etiology of dental caries. Thus the two problems might conceivably be carried out jointly, without serious sacrifice of time or material. I submitted an annual budget of three thousand dollars which I estimated, with the funds supplied by the University of California, would be sufficient to pay the various items of laboratory expense necessitated by such an ambitious experimental program. The allocation of these funds, at the suggestion of President Campbell and others concerned, was vested in an advisory committee.

THE VARIOUS ADVISORY COMMITTEES

The four advisory committees which have been appointed from time to time represent the following organizations:

1. President Campbell's Committee, appointed in 1928, and which still continues to function is made up of:

K. F. Meyer, Chairman, San Francisco,
University of California,
Director, Hooper Foundation for Medical Research.
A. H. Ketcham, Denver,
Member of American Society of Orthodontists.
James McCoy, Los Angeles,
Member of American Society of Orthodontists,
Member of Pacific Coast Society of Orthodontists.

2. The committee appointed from the membership of the American Society of Orthodontists: A. H. Ketcham, chairman; Harry Kelsey, Martin Dewey, LeRoy Johnson, Milo Hellman.

The membership of this committee is changed from year to year by one member being dropped off and a new one appointed.

3. The committee of the Pacific Coast Society of Orthodontists: B. Frank Gray, chairman; Allen E. Scott, Robert Dunn.

This committee was appointed this year to serve in place of various individuals who have made informal reports in preceding years.

4. University of California Research Committee: K. F. Meyer, chairman; B. E. Lischer, R. W. Rule.

This committee reports to the Board of Research of the University of California and serves as an important liaison between the College of Dentistry, the Hooper Foundation, and the American Society of Orthodontists.

PERSONNEL

All of the orthodontic appliances which have been used in this research have been placed on the experimental animals and adjusted from time to time by the following practitioners of orthodontics:

A. E. Scott, 10 monkeys; G. H. Grover, 9 monkeys; R. D. Hering, 2 goats; J. K. Diment has continued Dr. Hering's work.

TECHNICAL OPERATIONS

The technical operations in connection with the preparation of sections for microscopic study have been executed by Miss Noble. She devotes her entire time to this work. During the few months' interval when she was recovering from her accident some of the work was carried on by temporary assistants.

ANIMAL CARETAKERS AND STUDENT ASSISTANTS

In addition an animal caretaker has been employed, on a part time basis. His duties consist of cleaning the cages daily, feeding and watering the animals and holding the animals while the appliances are being adjusted. In this latter work various students and instructors also have volunteered their services from time to time, others have been paid at the university rate of fifty cents per hour.

SELECTION OF ANIMALS

One of the most important parts of any biologic experiment is to select the animal which best meets the requirements imposed: For example, comparing the relative merits of dogs and rats as material for dietary experiments, several facts have been mentioned by McCollum which indicate that dogs are less suitable for laboratory experiments than rats. Not only are dogs very liable to the direct effects of intestinal worms, but they develop other intestinal disturbances, as well as deformities and infectious diseases, particularly distemper. But the rat, on the contrary, thrives under laboratory conditions and "is therefore the animal of choice for studies of nutrition."

In experiments which involve banding of teeth it should be pointed out that the shape of the carnivore's teeth is totally different from that of man's, especially in so far as the molars are concerned. It is almost impossible, therefore, to place an orthodontic appliance in a dog's mouth which will compare directly with the type used in the orthodontic clinic.

There is also the disproportion between crown and roots of dog's teeth as compared with man's. The shape of the roots, their size, number and position in the jaw, all add factors of undetermined importance, which conceivably may complicate the whole problem.

It is generally accepted that the monkey is nearer man than any other species. The shape of the teeth, their size, position and attachment are all more similar to the human being than those of other available experimental animals. The criticism that they are difficult to handle and that they are more subject than other animals to disease is unwarranted. The monkey is not difficult to use or to keep in a state of health, provided he and his cage and utensils are kept clean. Unhygienic conditions naturally favor disease. I have had practically no difficulty in keeping my animals free from lung infections. Sometimes when sawdust, by mistake, is used in the cages, instead of coarse wood shavings, monkeys will eat enough of this fine stuff accidently to cause intestinal disturbances which frequently develop into a fatal bacillary dysentery.

The rapidity of the skeletal development is also of importance in carrying

out experiments of this nature. It is equally necessary that a definite basis of comparison be established between the rate of growth in animals and man so that the age relationship may be more clearly approximated.

THE TEETH OF MACACUS RHESUS

The teeth of macacus rhesus show certain similarities to the teeth of man, not only in gross and microscopic anatomic features, but also in sequence of development and number of teeth. Although the order of their eruption through the jaw at certain periods of life is not always the same, the variations fall within limits narrow enough to draw certain conclusions as to the age of the animal.

The dental formula of the deciduous teeth is as follows:

$$i\ \frac{2-2}{2-2} \qquad c\ \frac{1-1}{1-1} \qquad m\ \frac{2-2}{2-2} \text{ equals } 20$$

CALCIFICATION OF THE DECIDUOUS TEETH OF MACACUS RHESUS

Stillborn animals of a gestation period of 153 to 169 days show partial calcification, as indicated by roentgenographs, only of the deciduous incisors, canines

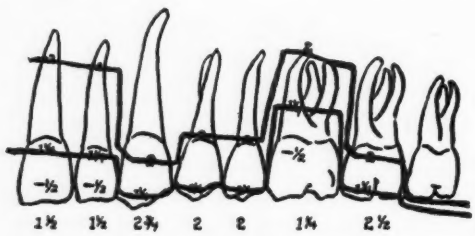


Fig. 1.—Calcification and eruption of permanent teeth in macacus rhesus. The numbers upon each tooth represent, in years, the progress of calcification. The lower black line indicates the degree of calcification at one and one-quarter years of age. The upper black line indicates the degree of calcification at two years of age.

and first molars. There is no evidence of calcification of the deciduous second molars or of the permanent set of teeth. After the tenth day of extrauterine life the four deciduous central incisors, two in each jaw, may be expected to erupt. Of seventeen examined, one animal under one month of age erupted the mandibular deciduous central incisors through the gum at two days of age. In none of the others was there definite evidence of this degree of development until after the ninth day. During the first month of life only the deciduous central incisors erupt.

Of fourteen animals, between thirty and sixty days' extrauterine life, four had erupted all the deciduous incisors and the deciduous first molars. There was no evidence, at this age, even of the beginning of calcification of the permanent teeth. Roentgenographs of animals between thirty and forty days old show well developed calcification of all deciduous teeth; but they do not erupt teeth other than the deciduous central and lateral incisors—maxillary and mandibular. This ten day interval seems to be a period of less active dental development than the following one. Between forty and fifty days the deciduous canines and first molars may be expected to appear through the gum line. This was the case in half of the animals examined; in the other half the eruption was delayed until about the

eightieth day of extrauterine life. By the time the animal is three months old the eruption of the deciduous set of teeth usually is completed. In a small proportion of animals the second molar did not appear until the fourth month.

The dental formula of the permanent set of teeth is as follows:

$$\text{I } \frac{2-2}{2-2}; \quad \text{C } \frac{1-1}{1-1}; \quad \text{P } \frac{2-2}{2-2}; \quad \text{M } \frac{3-3}{3-3} \text{ equals } 32$$

CALCIFICATION OF PERMANENT TEETH OF MACACUS RHESUS

The calcification of the second set of teeth was not demonstrated roentgenographically until after the sixth month. At this time the permanent maxillary central incisors were half formed. No further development was observed until about the fifteenth month (sometimes this is delayed until the eighteenth month), when the permanent first molar usually breaks through the gum tissue. The crowns of the permanent incisors are nearly formed, but only the tips of the crowns of the first and second premolars, canines and second molars are formed. The third molar is not demonstrable in the roentgenographs so early in life. At this same age the resorption of the roots of the deciduous teeth has advanced to the extent of approximately half the root length.

THE RESORPTION OF THE DECIDUOUS TEETH OF MACACUS RHESUS

There is a reasonable uniformity in the sequence of this process. The mandibular central incisors are usually the first to be shed, then follow, in fairly regular order, the mandibular and maxillary central incisors, the mandibular lateral incisors, the maxillary lateral incisors, the mandibular first molars, the maxillary first molars, the mandibular second molars, the maxillary second molars, the mandibular canines, the maxillary canines. There appears to be somewhat less regularity in the time of shedding the posterior deciduous teeth than has been observed in the anterior ones.

THE ERUPTION OF THE PERMANENT TEETH OF MACACUS RHESUS

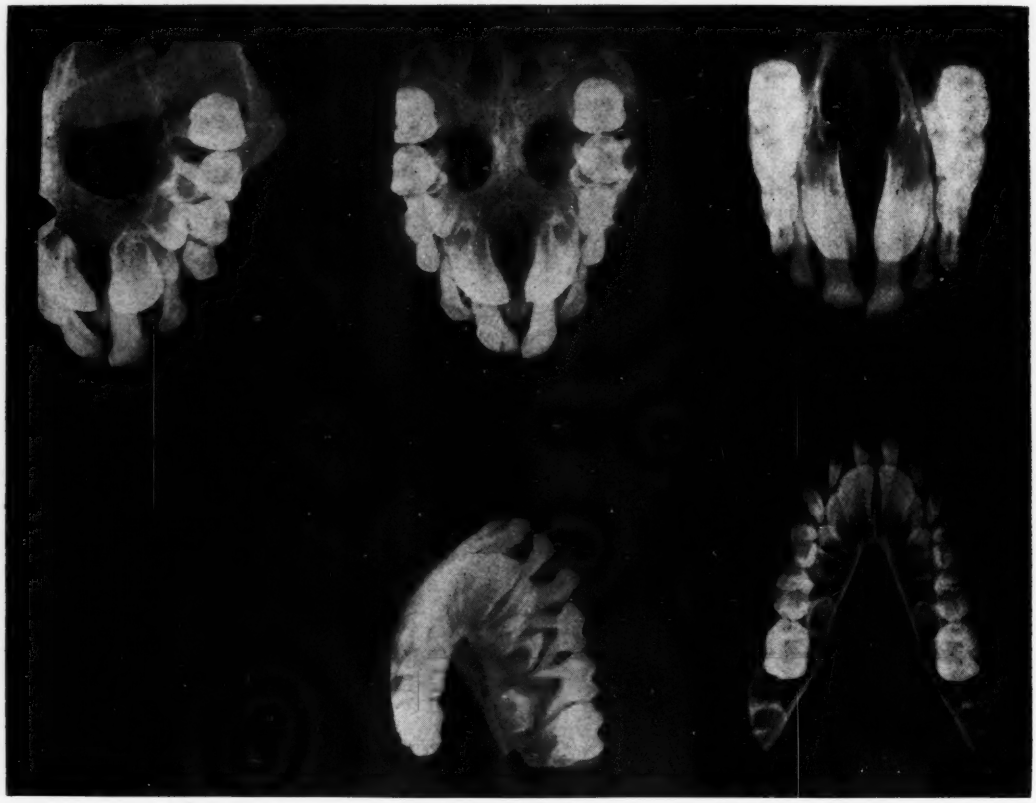
The time of eruption of the permanent teeth is nearly as regular as that observed in the human family. The first permanent tooth to appear is the first molar, about the fifteenth month; then follow the central incisors, the lateral incisors, the first and second premolars, the second molars, at two and one-half years, the canines at three years and finally the third molars.

At two years of age the calcification of the permanent teeth has progressed to such an extent that the outline of the incisors, both crown and root, is clearly shown.

The available data of animals between two and four years are somewhat fragmentary but indicate that the rate of formation of the crowns of the permanent teeth may vary to a slight extent. For example, in one animal exactly two years old, the permanent incisors were fully erupted and completely calcified; the incisal half of the canine crown was calcified, as indicated roentgenographically. Thus in the nine months' interval from fifteen months to two years, the formation has been slower, apparently, than during other intervals of similar length. In another animal, aged four years and three months, one of the deciduous teeth, the maxillary right second molar, was still in place. The roentgenographs indicated that the permanent first molar, though fully formed, was unerupted. The per-

manent second molar likewise was unerupted, although the crown and half the root were calcified. Exactly one year later, the same deciduous molar was still in place in spite of the complete eruption of all the permanent teeth. This produced a faulty alignment of the teeth in the maxillary arch which resulted in a pronounced malocclusion.

Normally at five years the eruption and calcification of the permanent teeth are completed, but it is by no means unusual to find marked variations in their position in the jaw. In one animal six years old, the mandibular permanent canines had not erupted. In another, the third molars, although calcified, were



A

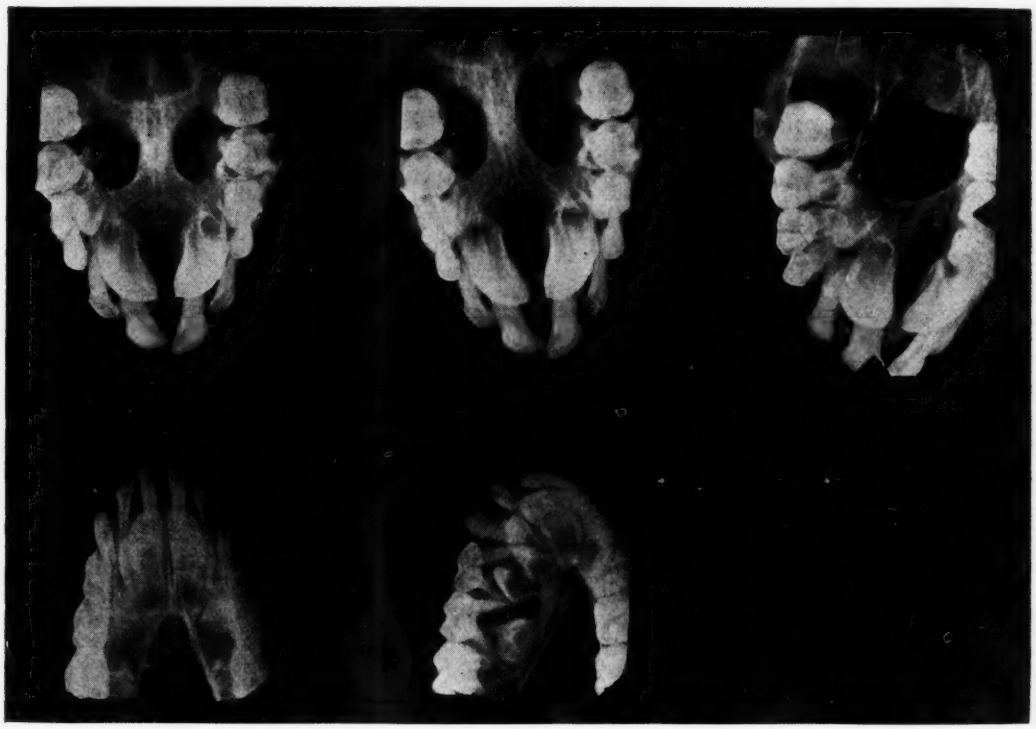
Fig. 2 *A*.—See legend under Fig. 2 *B*.

unerupted. In one of the nine-year-old animals all the permanent teeth were fully erupted except the third molar. This tooth was beginning to break through the gum line and half the root was calcified.

DENTAL PATHOLOGY IN MACACUS RHESUS

Dental examinations of animals of ten, eleven, twelve, fourteen and fifteen years, indicate that the teeth are subject to dental caries and attrition. In caries the condition may progress to the formation of a chronic apical abscess. In attrition the crown may be worn away to the gum line. There is a corresponding recession of the pulp. No evidence was observed of erosion or of hypoplasia. A cleft palate was noted in one animal of unknown age.

The inclination of the teeth from the median line is exactly opposite to that observed in man. The crowns of all posterior *maxillary* teeth, instead of having a slight inclination toward the cheek, as in man, show an axial direction toward the tongue. If a line be drawn through the long axis of the tooth, it will not be parallel to the median line of the body, but the crowns will slope *inward* toward the median line. The roots, similarly, will diverge from it. All *mandibular* posterior teeth, if inclined at all, have an axial direction toward the cheek. The roots of the maxillary permanent central incisors normally curve into an arc of nearly a quarter circle. Their apices diverge from the median line and, lying



B

Fig. 2.—Maryanne Macacus Rhesus, aged fifteen months. Radiographed by Dr. A. H. Ketcham.

in a plane nearly perpendicular to the long axis of the crown, point toward the nasopharynx.

COMPARISON OF MATERIAL SECURED FROM MAN WITH THAT FROM EXPERIMENTAL ANIMALS

In seeking for experimental material the question was raised as to whether or not clinic patients might be made available. The objections to the plan are almost too obvious to enumerate. We cannot assume that any patient would be willing to submit to orthodontic treatment and then later undergo an operation which would involve the removal of not only the teeth concerned, but also part of the adjacent soft tissue and bone. It is necessary that a considerable amount of bone be included whenever sections are prepared for this type of study. Another objection, of course, is that the skeleton of man develops too slowly. It is desir-

able to learn, if possible, the changes which take place during the period of adolescence and to trace later the effect of these changes in the adult. The minimum time for such an experiment would be ten years because the patients, even if they were available, should be, at the beginning of the work, not older than twelve years. The teeth would not be obtained until the patients reached maturity. During this ten year period, assuming that the patients were available, no control could be exercised over the diet of the individuals.

As has been pointed out the macacus rhesus approaches more closely the requirements of the experiment than any other animal available. Both the dental and the oral tissues are similar to those of man. The position of the teeth, the number and size are likewise similar. Furthermore, in properly conducted operative procedures, the animals are not difficult to handle. The objection to the use of these animals was the lack of a direct age comparison between macacus rhesus and man which would permit definite conclusions to be drawn in regard to the rate of development of the teeth. This material is now available as given in Fig. 1.

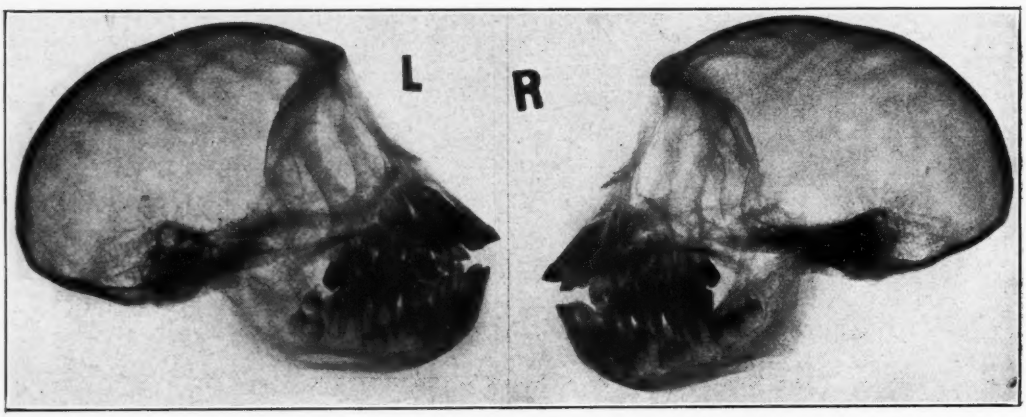


Fig. 3.—Right and left lateral views of skull of monkey shown in Fig. 2.

TECHNICAL PROCEDURE FOR PREPARATION OF SPECIMENS

Fixing and Hardening.—It may not be out of place to review briefly the various technical steps which are to be followed for the preparation of the tissues for microscopic examination. The tissues should be secured directly at the death of the animal and fixed in a normal saline solution which contains 10 per cent formalin. This solution should be exactly blood temperature at the time the tissue is placed in it and so maintained, in an incubator, for twenty-four hours. The tissues remain in this fixative not less than a week, after which they are washed, in running water, from twelve to twenty-four hours and then placed in 35 per cent alcohol for two days. They are then carried on through the successive grades of alcohol up to 80 per cent in which they are stored until ready for further technical procedure.

Decalcification.—A great deal of experimental work has been done on decalcification, and we have used various concentrations of nitric acid, hydrochloric acid, formic acid and sulphur dioxide. The most uniform results have been obtained with a 5 per cent solution of nitric acid. Instead of taking the material directly from the 80 per cent alcohol it is more advisable to dehydrate the whole

block of tissue by running it up to absolute alcohol and then back to 80 per cent alcohol. The nitric acid solution is made up in 80 per cent alcohol and is changed twice a day until a chemical test, to be described later, proves that all calcium phosphate in the bone and teeth has been dissolved by the decalcifying fluid.

The optional method of decalcification is to carry the tissue up through the various grades of alcohol and then place it in a 4 per cent solution of celloidin. To this is added a 5 per cent solution of nitric acid made up in an ether-alcohol fluid. This procedure complicates, later on, the process of exhausting the tissue under vacuum, but, for the delicate structures, as for example enamel matrix, it is an invaluable but intransigent method.

The test solution which is used to determine the end point of decalcification is one described in Treadwell and Hall's *Analytical Chemistry.* It consists, essentially, in testing for the presence of phosphate, precipitated as ammonium phosphomolybdate. The directions are as follows:

One hundred gm. of molybdic acid are dissolved in 250 c.c. distilled water to which have been added 150 c.c. of concentrated ammonium hydroxide. Stir this mixture until dissolved, then add 65 c.c. of nitric acid (sp. gr. 1.42).

Solution II consists of 400 c.c. nitric acid (sp. gr. 1.42) plus exactly 1,100 c.c. distilled water. When the solutions are cold, add Solution I to Solution II, pouring slowly with constant stirring. Then add a few drops of concentrated solution of tribasic ammonium phosphate. A precipitate of ammonium phosphomolybdate settles out slowly, then the reagent is decanted and is ready for use. To test the tissue for the presence of calcium a few cubic centimeters of the decanted decalcifying solution are placed in the staining dish and a few drops of the ammonium phosphomolybdate solution are added to it. As long as a precipitate is formed, phosphorus, as calcium phosphate, is present in the piece of tissue.

EMBEDDING AND ELIMINATION OF AIR POCKETS

After decalcification the tissues are placed in increasingly stronger solutions of celloidin. For this purpose the Dupont parlodion is used. In making up celloidin solutions it is essential that each piece of substance be wiped thoroughly dry before it is placed in the ether alcohol liquid. When the tissues have been placed in 16 per cent celloidin for at least two weeks, the open dish containing the specimen is placed in a vacuum dessicator. It is then subjected to a vacuum which must be so adjusted that the bubbling of the parlodion solution is reduced to a minimum. In a few moments bubbles of air will be seen to emerge from the specimen and will continue to rise to the surface of the celloidin almost in a continuous stream. This process of exhausting all air is extremely important when large pieces of tissue are being cut. It sometimes requires eight to ten hours for completion of the process. During that time it is necessary, of course, to maintain in a fluid state the 16 per cent ether alcohol solution of celloidin by addition of ether alcohol, otherwise the material becomes so thick that no air will be drawn off from the specimen. It is equally important that the negative pressure be kept so low that, when air exhaustion is accomplished, no tearing of the tissue occurs. When the exhaustion is completed, the specimen is placed in a thick celloidin solution and imbedded in this matrix on the microtome block, preparatory to

cutting. If these directions are carefully followed, it is easy to cut whole sections of a jaw from a grown animal, monkey or dog, to at least fifteen micra thickness. Serial sections are made of tissues, saving approximately every fourth section.

Cutting.—The microtome knife should be examined with a low power objective to be sure that the edge is true and even. Steel which is too hard will fracture and cause large tears in the section. Steel which is too soft will not hold its edge. For purposes of convenience and economy in maintaining an adequate knife edge, I have found it essential to use a special grinding instrument perfected by Professor Joseph Long of the University of California Department of Zoology. This consists, essentially, of a glass wheel mounted on a high speed motor. The wheel fits a deep trough in which is poured a thin suspension of levigated alumina (Norton Co.), and water.

Staining.—The following differential stains are used:

1. Hematoxylin (Harris), and eosin, for the purpose of nuclear differentiation and for identification of mucous membrane.

2. Mallory connective tissue stain, for identification of different types of connective tissue and capillaries.

3. Van Gieson stain, for differentiation of various types of connective tissue.

4. Schmorl, for differentiation of the tissue elements found in hard structures (dentin, cementum and bone).

It has been found advisable to maintain the following sequence of stains in each series of slides:

Section 1 hematoxylin and eosin
Section 2 Mallory
Section 3 Van Gieson
Section 4 Schmorl
Section 5 hematoxylin, and so on thus repeating the same sequence all through the specimen.

Specimens are mounted on thin slides, 2 by 3 inches, rather than the usual 1 by 3 inches. These require special size cover glasses, otherwise air works around the edge of the cover slips. The tissues are mounted in gum dammar instead of balsam. Gum dammar is made up from freshly selected gum, free from extraneous matter. It is dissolved in xylol, filtered and placed in a covered beaker on the water bath where it is permitted to evaporate slowly until a workable consistency has been reached.

Some of these various technical details were standardized on experimental material prior to the work on monkeys.

COMPARISON OF NORMAL AND DEFICIENT DIETS

The original dietary plan, as outlined in 1928, contemplated the division of the animals into two groups, one of which would be maintained throughout the course of the experiment on what we considered to be a normal diet, that is to say, a diet comprised of fruits, vegetables, meats and bread. The animals have remained healthy and have shown normal growth weights. The other group would be given a diet adequate in all respects but deficient in vitamin A. But

these animals have, with difficulty, been maintained on the restricted schedule. The formula for the diet is practically the same as that used since 1924, employing rats as the experimental animals. The nutrition deficiency has been concerned more with vitamin A than with any other of the vitamins.

An analysis of these diets by Drs. McCollum, Kline and Kruse* shows that the diet "contained 0.35 per cent calcium and 0.51 per cent phosphorus, which may be considered borderline to caries production. On this diet two female rats, one 435 days old and another 375 days old, were cited as examples of animals developing molar caries. On the other hand, a male rat which was 134 days old and which was fed the same diet did not show caries. Here two considerations are in order: The male was restricted to the diet for a much shorter time than were the females; consequently, its failure to develop caries is consistent with our experience."

The ration used for vitamin A deficiency is as follows:

	PER CENT	GM.
Casein (extracted with alcohol)	25	250
Corn starch (cooked)	69	690
Salts (McCollum No. 185)	4	40
Lard (irradiated)	2	20
	100	1000
Yeast—daily		0.3

Salt Mixture (McCollum No. 185)

	GM.
Sodium chlorid	0.173
Magnesium sulphate (anhydrous)	0.266
Sodium biphosphate (monobasic)	0.347
Calcium acid phosphate (monobasic)	0.540
Ferric citrate	0.118
Calcium lactate	1.300
Dipotassium hydrogen phosphate (dibasic)	0.954

The results which we obtained on rats as described in 1927† justified the continuance of this diet with monkeys. From time to time certain changes have been made in the diet with the intent to make it more palatable to the animals. This has met, however, with no conspicuous success; and it has been necessary, on several occasions, to take the animals off the diet rather than run the risk of losing them by starvation.

RESULTS OF RESEARCH

Appliances have been placed on the teeth of animals from one day to 293 days as a single period of application. This corresponds in human age from five days to over four years. Much material has been reported, but a summary of the work accomplished may serve to indicate the degree of progress which has already been made:

The plan of attack on the problem is indicated by the following outline:

1. What histopathologic changes occur in pulp, dentin, cementum and paradentium during the normal process of shedding of deciduous teeth? These changes were reported, partly, in the paper given in October, 1928, and partly

*The Production of Caries Immunity and Caries Susceptibility in Experimental Animals. The Significance of Phosphorus and the Calcium Phosphorus Ratio. (In press.)
†Dental Caries and Pulp Sequelae on Experimental Rats. J. A. D. A. January, 1927.

in my book, *Diseases of the Teeth—Their Diagnosis and Treatment.* Having in mind the normal sequence of changes, it next was necessary to determine:

2. What histopathologic changes occur in pulp, dentin, cementum and paradentium as a result of infection? In what respect do these changes differ from those observed during the normal process of shedding deciduous teeth? It was found that the sequence in this case was somewhat different, due, of course, to the presence of the organisms themselves and of their products.

With these facts clearly demonstrated, the next part of the problem consisted in determining whether or not bone and tooth resorption could be produced experimentally, and, if so, how it could be done—what factors control it—are they purely local, or both local and general—what type of mechanical force produces resorption, and how may this be avoided—what differences and similarities do the three processes show, that is to say, is the histopathologic picture of normal resorption of deciduous tooth roots and the pathologic resorption in infection similar to, or different from, that observed in the experimental resorption by mechanical force?

These questions are still being studied and the results so far obtained indicate: first, that animals on a full diet suffer least from injuries of the nature above mentioned; second, that although resorptions occur, the resorbed areas are rapidly rebuilt after the pressure has been removed: third, that animals on deficient diets show a greater degree of resorption, using the same appliances, than those on an adequate diet; fourth, that these resorbed areas, from animals on deficient diets, are greater in extent and are repaired more slowly; and fifth, that the active processes produced experimentally are similar to those of normal resorption of deciduous tooth roots, but dissimilar to the lesions observed in infections.

Several other facts, also hitherto unsuspected, have been demonstrated in the histopathology of these lesions. In certain teeth on which the tension was relatively mild, but long continued, there was evidence that secondary tubular calcification of dentin occurred on those root portions subjected to the greatest strain. It is a well known fact that in the crown of the tooth this response of pulp to mild irritation frequently occurs as a defensive mechanism against injury to the pulp, but, previously, it has not been recognized as a condition which may develop in the root. The effect produced is that of an ever widening granular layer of Tomes.

Exactly the opposite result is found in roots of deciduous teeth having normal pulps where active resorption is taking place. The fibers in the decalicified dentin matrix appear larger, as though swollen, and also seem closer together than the fibers in areas where no active resorption is occurring.

The tissue reactions which the pulp exhibits under the indirect influence of deficient diets are also worthy of note. In rats, dogs and monkeys, I have demonstrated numerous calcified areas of secondary dentin developing within the pulp substance. Furthermore, in developing teeth the zone of predentin, instead of being regular and composed of fibers evenly placed, becomes exceedingly irregular, increases in depth and is made up of fibers which tend to bunch together like bundles of fagots. In the normal developing tooth, this is not the case.

REVIEW AND DISCUSSION OF RESULTS FROM OTHER LABORATORIES

Up to the present time I have not offered a critical review dealing with the experimental work on dental and osseous resorption and the theories advanced in explanation of these phenomena. I believed that unless new facts could be presented a mere discussion would serve no useful purpose. Consequently the papers I have published have been in the nature of progress reports. This, however, seems to be an opportune occasion to correlate such new facts as have been demonstrated in the laboratory with facts well known from clinical observation.

Oppenheim.—Oppenheim's work, published in 1911, was interesting as a preliminary experiment, but, of course, inconclusive; for the resorption which he describes might have occurred without any experimentally produced mechanical trauma. He made the error of working on deciduous teeth of a single ape, and thus the normal growth processes, by which these teeth were shed, complicated and probably obscured entirely any effect which might have been produced by the two pressures of extrusion which were applied. His findings, therefore, on tooth movements, as studied histopathologically, are of little value. Permanent teeth should have been used, and also, several animals.

Ottolengui.—None of the various views held concerning "physiologic resorption" and "pathologic resorption," as correctly designated by Ottolengui, explain satisfactorily these phenomena. They fail to satisfy the various features not only in etiology, but also in pathogenesis, histopathology and prognosis. As Ottolengui so ably points out the resorption of deciduous roots "is in no physical sense dependent upon the eruption of its successor."

Dewey.—Dewey refers to a constitutional factor when he mentions that in rickets there is a late eruption of deciduous teeth and also an early loss due to imperfect calcification of their roots.

Johnson.—Johnson's work was interesting and correct up to a certain point, but one detail was overlooked which would have made his experiment of great value. In making microscopic examinations of teeth which normally present a curvature, it is necessary that one reconstruct in one's mind the appearance of these teeth at different levels in the tissue. For purposes of comparison, a rubber tube may be bent to about the same curvature as that found normally in maxillary central incisors of macacus rhesus. If this tube is cut through longitudinally, commencing on the convex surface, none of the cuts made will show the entire length of the tube. As the lumen of the tube is reached, a hollow area will be exposed, and the walls of the tube will appear less thick. The same applies to a tooth. It is necessary, therefore, in cutting sections, to bear this point in mind; sections cut labiolingually, that is, from the labial toward the lingual surface, will show whether the tooth was moved in a mesial or distal direction, but they will not show any *labial* or *lingual movement*. To demonstrate this point, it is necessary to cut serial sections, beginning, perhaps, at the middle of the approximating tooth, either the central or the lateral. If, for example, a right central incisor is to be studied, the tissue is so mounted that the sections may be cut beginning at the right lateral incisor and continuing in a mesial direction through the right central and even left central incisor. Sometimes the shape of the block is such that it is more convenient to begin cutting from the

left central incisor and to continue through the right central and right lateral incisor. However, in one research conducted by another worker, the "sections were cut longitudinally (sagittally) in a labiolingual direction through the center of the pulp of the tooth."

The experiment was one in which movement of the left maxillary central incisors was in a palatal direction. In order to show bone changes in this type of movement, it is necessary to study the tissue from the distal or mesial aspect of the specimen, rather than from the labial or lingual aspect. In fact a false impression may easily be obtained in attempting to interpret sections which are cut in the wrong direction. Thus a clear picture would not be given of the difference between the position of the tooth under movement, and the tooth in a controlled animal.

Gottlieb.—Gottlieb has recently described some experiments on what he calls, I hope facetiously, "traumatic occlusion." May I say, parenthetically, that those two words seem to be the direct antithesis of each other? Trauma means injury—occlusion describes a normal anatomic relation of the teeth which would not exist if an injury was being applied to them. But the emphasis is merely misplaced. The idea to be conveyed is that misdirected occlusal stress will produce—not "traumatic occlusion"—(it could not, if the meaning of the words be accepted) but it will produce *occlusal trauma.* Gottlieb used dogs as experimental animals and cemented metal caps to several teeth. The pressures which he applied, in some cases, were so severe that the root of the tooth was brought into actual contact with bone. Neither children nor monkeys would tolerate such conditions; both would pull off the bands, but dogs cannot exert enough pressure with their paws to dislodge the bands.

In his experiments no resorption of cementum was observed, but instead there was evidence of osteoclasia. Ligation of a tooth for twenty-four hours produced stretching of the fibers in the periodontal membrane. Among the effects of a forty-eight-hour period of ligation was the beginning of formation of bone in the direction of stretched fibers. When the pressure is severe enough to force the root of the tooth into contact with the bone, the periodontal membrane, at the point of contact, is destroyed. No resorption of tooth root or of bone occurred at the point of contact. Instead of this another process set in by means of which the small area of bone in contact with the tooth is undermined. It is eventually isolated and resorptive processes encircle this small particle of bone.

Herzberg.—An article by Herzberg* describes a single experiment in which the maxillary right first premolar in a young woman, eighteen years of age, was moved in a lingual direction for a period of eighty days. The author admits that it is not the purpose of his paper to draw definite conclusions from this single specimen which has been presented. That is indeed fortunate, for the most important part of the tissue, namely the portion on the lingual aspect of the root was not secured at all. Bone changes were found on the buccal part of the alveolar process, due to the negative pressure, but these cannot be properly interpreted without studying the corresponding resorptive changes occurring in the palatal bone at the point of greatest positive pressure. Herzberg shows only those changes which may have occurred in the area of negative pressure. Furthermore, he not

*Bone Changes Incident to Orthodontic Tooth Movement in Man. (In press.)

only has misinterpreted the conclusions made in my first paper but fails entirely to mention my subsequent work.

COMPARISON OF RESULTS OF SIMILAR APPLIANCES ON TWO SETS OF ANIMALS (ONE ON A NORMAL DIET AND ONE ON A DEFICIENT DIET)

The direct comparison of monkey No. 81, regular diet, and monkey No. 4, special diet, shows, first of all, that they were both approximately the same age, thirty months in one case and twenty-nine months in the other. This corresponds, in human age, to twelve and one-half years in the first case and twelve years in the other. In both instances the central incisors were banded to produce movement of the crowns in a distal direction. There were periods of movement and periods of rest in monkey No. 81 as follows:

Banded 83 days (14 months human).

No bands 39 days (6½ months human), the teeth had now resumed their normal position.

Banded 125 days(21 months human) : Total 208 days that these teeth were banded.

Monkey No. 4 was banded continuously for 255 days. The bands were placed September 14, 1928, and examined from time to time and found to be intact. Although considerable movement had occurred by March 13, 1929, the tension on the wires was increased. Periodic examinations of the bands were made until the animal died on July 3, 1929, of bronchial pneumonia. The gall bladder was found to be about six times its normal size and was filled with bile.

The histopathologic picture of the teeth of these animals has already been described in detail. Suffice it to say that monkey No. 81, on the regular diet, did not show the same degree of radicular resorption as that observed in monkey No. 4; the movement of the teeth of the two animals was the same, the age almost identical. The main difference consisted, first of the fact that monkey No. 81 was on the regular diet and monkey No. 4 on the special diet; and second, that the tension on the teeth of monkey No. 81 was greater than on monkey No. 4.

Monkey No. 35 and monkey No. 2 also offer interesting comparisions; a summary of which is given in Table I.

There is a greater discrepancy in the age of these two animals than there was in the first two discussed. In the case of animal No. 35, on the regular diet, the banded molar was tipped slightly distally. With monkey No. 2, special diet, instead of this movement, there was produced a slight rotation in the mesiolingual direction. The right central incisor in animal No. 35 and the left central incisor in No. 2 were given an intrusion tension. In both cases there was observed resorption of bone and apex of root. In the animal on special diet the degree of resorption was relatively great. In fact, in monkey No. 2, the pressure was such that pulp in the left central was strangulated.

COMMENTS ON THE EXPERIMENTS

There is still a considerable amount of unfinished material to be studied from a histopathologic standpoint. As fast as this can be worked up and examined, reports will be published. Some of the animals will serve as controls from

a standpoint of dental development; the others will comprise those upon which bands have been placed for various periods of time. This constitutes one part of the unfinished research, and it is hoped that the material yet to be presented will throw further light upon this interesting, but perplexing, problem of apical

TABLE I

MONKEY NO.	DIET	AGE OF MONKEY AND EQUIVALENT HUMAN AGE	TYPE OF APPLIANCE	LENGTH OF TIME APPLIANCE WAS IN PLACE	VARIOUS MOVEMENTS OF TEETH	DESCRIPTION OF HISTOPATHOLOGY
35	Reg.	Approx. 33 mo. Human 13½ yr.	Right canine bracket band. Right central bracket band. Right first molar banded. Regular ribbon arch from first molar to canine to central.	Molar banded 64 days (10⅔ mo. human). Right central and right canine were banded 64 days (10⅔ mo. human) 10-12-28 to 12-14-28. Right central and right canine were banded 96 days (16 mo. human).	Distal tipping of molar. Right central intruded. Right canine intruded. Upon rebanding: Right central labial movement and right rotation. Right canine intruded and mesial rotation.	Permanent first molar, slight lateral resorption on distal aspect of both distobuccal and mesiobuccal roots, followed, upon removal of pressure, by apposition restoring root contour. Right central incisor, pressure resorption of bone and apex of root.
2	Spec.	Approx. 20 mo. Human 8⅓ yr.	Maxillary left first molar banded. Central incisors banded. Arch wire attached from first molar to centrals.	50 days (8 mo. human) 11-16-28 to 1-9-29.	First molar mesiolingual rotation. Right central extruded. Left central intruded. Molar crown moved distally. Molar roots moved mesially.	Left permanent first molar shows deep pressure resorption with only slight amount of apposition. In right central elongation stress has pulled the bone trabeculae into a position parallel to long axis of the tooth. New bone formed slowly. The relatively large amount of fibrous connective tissue is loosely built. In left central intrusion pressure has strangulated the pulp. Apical foramen enlarged and deeply resorbed.

resorption. One difficulty, which so far has not been met, is in making direct comparisons of the pressure produced on the bone. It seems to me that the apparatus invented by Dr. Irish will provide some very useful information. The matter of tensile strength of wire and the factors which decrease it, and also

the rate at which this may be changed, are all of great importance to the orthodontist. *Guessing at the pressure produced upon the root is unscientific.* Means must be adopted for gauging and controlling this mechanical aspect of orthodontic practice.

NEED FOR ADDITIONAL STUDY

Future experimental work should satisfy certain requirements, among which may be mentioned the following:

First: Unless sufficient tissue can readily be secured, experimental work on man should not be attempted. It is not enough that the alveolar process immediately adjacent to the tooth root under movement be obtained. A considerable amount of tissue, certainly material which would include two adjacent teeth, is necessary if a correct histopathologic picture is shown.

Second: The animal selected for the experiment should have the type of teeth which resemble man. Dogs do not meet this requirement.

Third: The teeth banded should be permanent teeth rather than deciduous.

Fourth: Experiments of this nature must include a careful consideration of the dietary aspects; for the degree of response which the animal may make to the treatment is largely dependent upon its state of health.

Fifth: Age comparisons should be made between the animals and man, otherwise little application can be made of the research to clinical practice.

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DISCUSSION

Dr. Allen E. Scott, San Francisco, Calif.—About fifteen years ago, when I asked a prominent orthodontist why bone absorbs rather than the teeth during movement, he replied that he thought God was on the side of the orthodontist. Perhaps He is; some of us hope so. We all know that roots will resorb and that teeth will decay in mouths of people who have never even heard of an orthodontist. The mere fact that roots resorb simultaneously with orthodontic

treatment does not necessarily prove that the orthodontic treatment causes the root resorption; although it is admitted that at times it does seem incriminatory. I felt that this problem was of such great importance that almost any amount of time and money that was proposed to be spent upon it would be justified. I therefore offered Dr. Marshall my full cooperation, and I wish to take advantage of this opportunity to express my appreciation of his kindness of attitude and infinite patience in carrying on this work.

All of my work was done on monkeys. The monkey is an interesting animal. Perhaps this is so because he so closely resembles human beings, as Dr. Marshall points out. His muscles are very strong. In fact, when we first started this work, we thought it necessary to give the animals chloroform or ether in order to do satisfactory work. Later on, however, when the danger from tuberculosis and pneumonia became apparent, we succeeded in doing the work with the aid of a couple of husky dental students.

Almost all the tooth movement was produced by placing bands on the anterior teeth. The anterior teeth of the monkey are large, and the placing of bands on these teeth does not present much of a problem. Band material of 0.004 of an inch in thickness was used. To these bands were soldered loops of spring wire of 0.025 and 0.030 of an inch in diameter. When the character of the movement was decided upon, the appliance was so adjusted and cemented on the tooth.

An effort was made to place bands on posterior teeth but did not meet with much success. Our failures were due to two things: first, the posterior teeth are small and extremely hard to band; second, the wires extending from molar to molar can readily be grasped by the animal and pulled off.

When the appliances are first placed on the teeth of the monkey, his behavior is not unlike some children I have treated. For the first few hours he maneuvers to get them off, but evidently he soon forgets about their presence and apparently is contented and happy.

Care was exercised to treat these animals as we would human beings. On one or two occasions the appliance got out of adjustment and more pressure was applied than was necessary. Even though we could determine the amount of pressure applied when the appliance was placed, we cannot be positive that the pressure will remain constant because the wires may be bent in such a manner as either to increase or to diminish the original pressure.

So far this piece of research has made me come to the conclusion that every orthodontist should pay more than an ordinary amount of attention to the subject of diet. It seems to be established very well that deficient diets are conducive not only to dental caries and peridontoclasia, but to resorbed roots as well. There is a tendency for these roots to resorb much more under deficient diets than under normal diets. Furthermore, I do not think the dentist should be severely criticized when he presumes to tell parents what kind of food normal healthy children should have. If the physician were doing this, it would not be necessary for the dentist to do it.

Dr. Samuel J. Lewis, Detroit, Mich.—I just wanted to say that it was my privilege and pleasure to spend a day with Dr. Marshall last February in his laboratory, looking over his animals and slide material. It was a revelation to me, and I think we are to be congratulated on having Dr. Marshall conduct this experiment for us. Not having had the experiment presented to me properly at the start, I was rather skeptical about its value. Now there is no doubt in my mind as to its extreme value and importance, and it is my hope and wish that our society will continue the experiment to a point where Dr. Marshall deems it necessary. I want also to congratulate Dr. Marshall on the thoroughly scientific manner in which he has approached this problem.

Dr. B. L. Herzberg, Chicago, Ill.—This is my first attempt to appear before a Society that knows so much about orthodontia as you do, and I have relatively little to say except that I find Dr. Marshall's paper extraordinarily interesting, probably more so than most of you because I have done some work along this particular line.

The work I speak of was done at the Chicago College of Dental Surgery as part of the requirement of the graduate school in the Dental Department. The work done was on human material rather than on the experimental animals previously used, such as the macacus, baboon and dog.

It is very interesting to me that we found that the changes in human material under orthodontic therapy were quite like those found in the experimental animal. In fact, we came to the

conclusion that under analogous conditions, analogous results were obtained. This does not always hold for findings of experiments on animals as compared with those on man. For example, because various diets may bring about certain results in white mice does not mean that the same diet would bring about like results in man.

But in this experiment, where the maxillary first premolar of the human being was moved orthodontically, then removed with a portion of the bony process, we obtained results that were comparable to those obtained by Oppenheim and other investigators.

For that reason Dr. Marshall's paper is very interesting, and for that reason it seems to me that it is very important that experiments along the lines Dr. Marshall has pursued should be continued, because if the changes are like those obtained in human therapy, then we can feel assured that the results of further experiments on animals could be very favorably compared to those that would be obtained in the human being.

Our work was not with root resorption, merely with the changes that were obtained in the bony process. I feel the question that arises here and the thought that the Society should continue this type of work are very pertinent. The Society should consider it a great favor to have a man like Dr. Marshall carry out this work as far as it is possible to do so.

I have a few slides, and if it is the opinion of the group that they would like to see these seven or eight slides of human material, I should be glad to show them.

Dr. Waldron.—How did you get that material? Did you have to reseet part of the material?

Dr. Herzberg.—The first thing we had to do was obtain patients for whom, in our opinion, in diagnosing, it would be desirable to recommend that two teeth be removed, one on each side of the same arch. It would be necessary to have two teeth; one as a control, and the other as the experimental tooth.

In this experiment the maxillary right first premolar was moved lingually by direct intermaxillary force, a distance of approximately 2 mm. The tooth with adjacent tissue attached was then removed at the college clinic by Dr. P. G. Puterbaugh, under a local anesthetic. He used a tapered fissure bur No. 701. An attempt was made to do this in two cases, but enough bony process was obtained in only one instance. The material was treated histologically, and characteristic changes were noted. The bony process attached to the moved tooth showed orientation of the bony spicules in the direction of the force. The formation of new bony tissue (osteoid) could be definitely demonstrated, and the areas of resorption and apposition of bone are not unlike similar conditions described by Oppenheim and others. The periodontal membrane became widened as in animal experimentation.

In this type of experimental work the changes are similar to those found in monkeys, the teeth of which have been moved orthodontically and described by Oppenheim, Breitner and others. We can feel, therefore, that the changes noted in animals in this type of work would be quite like those obtained in human orthodontic therapy.

Dr. A. H. Ketcham, Denver, Colo.—It gives me great pleasure to say a few words in regard to the monumental work which Dr. John A. Marshall is performing for this Society. It is a research which is founded upon a vast amount of valuable work upon animals on deficient diets. This gives Dr. Marshall a foundation for our research which is broad, and makes his research work upon our twenty-two monkeys most accurate and of the greatest value to science.

Dr. Marshall's work is very thorough. He is not satisfied with sections prepared with only one stain. Each slide in each series of four sections or slides has been prepared with a different stain, for the reason that a greater degree of accuracy in his studies will be secured by so doing.

I think this work has quite clearly established the fact that diets deficient in vitamins do render animals more susceptible to resorption of the roots of vital permanent teeth. It has also established the fact that animals upon a full diet, or a well-balanced diet, are less susceptible to root resorption than the former when the teeth are moved by orthodontic appliances.

I think we also owe much to Dr. Allen Scott and his co-laborers, who have placed the orthodontic appliances upon the teeth of the monkeys and carried on orthodontic tooth movement.

The work has been performed under the general supervision of Dr. Karl Meyer, director of the Hooper Foundation for Medical Research, who is a research worker commanding the re-

spect of men in his line all over the world. Furthermore, it has been carried on very economically. All funds have been disbursed after vouchers have been signed by the University of California George William Hooper Foundation Orthodontic Research Group composed of Karl F. Meyer, Chairman, James D. McCoy, Ben E. Lischer and Albert H. Ketcham. Dr. Marshall has never received one penny for his work. He is giving his services gratuitously to this Society. Dr. Karl Meyer tells me that Dr. Marshall gives outside time of at least twenty hours a week to our work. I know you all feel we owe a great debt of gratitude to Dr. Marshall.

A large amount of material remains to be studied. Through the economical management of the funds, there remains over $3000 on hand which will take care of the expenses incident to this research, such as technicians and caretakers, for the coming fiscal year, or from July 1, 1932, to June 30, 1933.

I feel this research will prove to be of great value to orthodontists. Already the findings have caused many of us to be more careful to understand the physical condition of the patients whom we are treating, to watch nutrition much more carefully, and to solicit the aid of the pediatricians more often than we have in the past.

I shall close my remarks with a word of appreciation to the men working with Dr. Marshall, Dr. Karl Meyer, Dr. Allen Scott, and his coworkers.

Dr. E. N. Bach, Toledo, Ohio.—I wonder whether Dr. Marshall will include in his closing remarks what he considers a normal and a deficient diet for monkeys. This will provide considerable information on the subject for many of us.

Dr. John A. Marshall, San Francisco, Calif.—I should like to explain one point that Dr. Scott mentioned. He said something about the danger of lung infections in our animals. What he meant was this: When an animal is given a general anesthetic, ether, chloroform, or gas, it does not recover from the anesthetic as quickly as a human being. The two animals I did lose from pulmonary infection were those that had been anesthetized, so I discontinued general anesthesia entirely. I had to sacrifice, therefore, making complete models of any of my cases because I was unable to obtain a satisfactory impression. I know that the records of orthodontic treatment are based on models. But I cannot show you any models of monkeys because when a monkey wants to swallow, and he is not anesthetized, he is going to swallow whether he has plaster in his mouth or not. I want to tell you that one of the most exciting operations (if not sports) is trying to remove pieces of plaster from a monkey that is snapping at you all the time. So I have not any models to show you. I have to rely entirely on photographs and radiographs.

As far as *normal* diet is concerned, that is a very much misused word. A normal diet, in my estimation, means a well-balanced diet. It does not mean that you have to take half a teaspoonful of vitamin A this morning and half a teaspoonful tonight, and a third of a teaspoonful of vitamin D tomorrow. If there are enough fresh vegetables, dairy products, fresh fruit, and so forth, one will not suffer very much. The *naturally occurring* food stuffs are those which contain the various dietary elements in sufficient amounts.

At once you will say, "What about white flour and white sugar?" Eat them, but do not eat them to the exclusion of everything else. Candy does not hurt anybody as long as it is not eaten at a time when it interferes with the appetite. That is the trouble with candy; it takes off the edges—the keenness of the hunger. I remember what I used to do when I was a boy, and I will bet you did the same thing. Along about five o'clock in the afternoon I sneaked down to the store and got five cents' worth of candy and ate it. When it came time for bread and potatoes, spinach, carrots, and all the rest of it, I said, "I don't want to eat any more." That is the way it is with youngsters today, and that is the way it is going to be for a long time. This age of civilization has brought with it a perverted appetite. In the jungle the animals and primitive man eat when hungry.

May I speak for a moment about deficient diets. In 1922 McCollum worked out a diet which was called the basal ration, a ration which might serve as a base. It contained no vitamins; they were added as necessary. This basal ration has been in use in my laboratory for ten years with varying results in different animals. For example, for these particular animals on which I work, the basal ration consisted of ether and the alcohol extracted casein, (to give the protein), cornstarch, McCollum's salt mixture, and irradiated lard. To that was added yeast to

provide the water soluble vitamins. The irradiated lard provided the vitamin D, so that the only vitamin lacking was A.

In a recent review of this whole subject of diet in a paper by McCollum, as yet unpublished, he has analyzed all the dietary researches of the last ten years and has pointed out that his own diet as well as mine was not only deficient in vitamin A, but was also on the borderline of the calcium phosphorus deficiency. The calcium phosphorus ratio is a very, very important angle of this problem of diet.

The whole matter simply boils down to this fact: we have to put more thought upon eating the naturally occurring food stuffs, cheese, butter, milk, and other dairy products, as well as vegetables and fruits, meat, eggs, and fish.

INDIVIDUAL MEASUREMENTS OF THE FACE AND JAWS BEFORE AND DURING ORTHODONTIC TREATMENT*

DR. RUDOLPH SCHWARZ, BASLE, SWITZERLAND
Professor of Orthodontia, Dental Institute of Basle

STUDENTS of orthodontia who are engaged upon the difficult problem of the growth of the jaws are particularly indebted to a few anatomists for their recent endeavors toward a solution of certain questions which are of special importance in orthodontia. I may mention by name Bolk, Keith, Bluntschli, and Brash.

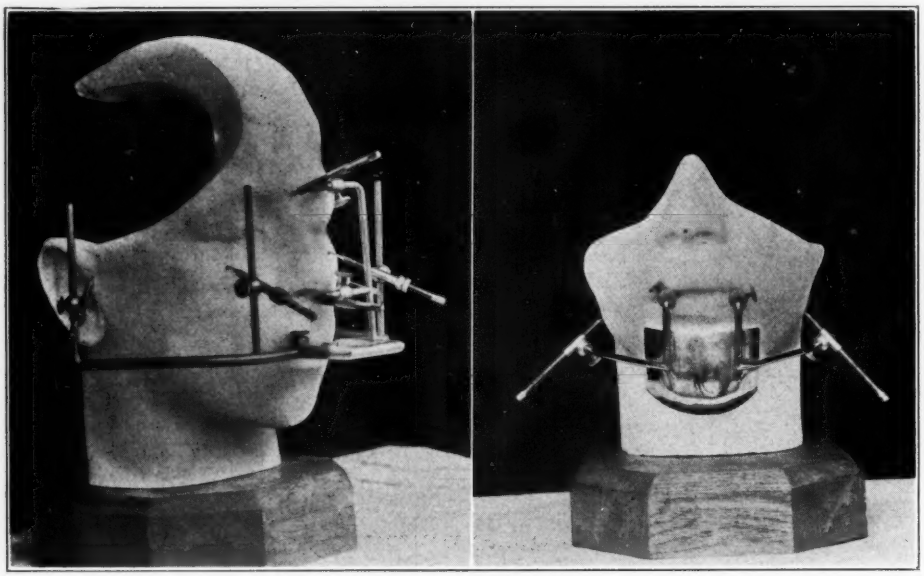


Fig. 1.—Face bow and chin cap.

Brash in carrying out experimental studies on young pigs of the same litter, but at various ages, has prepared some highly instructive sections which all orthodontists ought to study, showing as they do very neatly where new bone is formed. Brash has placed in superimposition the drawings of mandibles at different ages, so that the drawings give accurate information as to the direction in in which and the places where the growth of the jaws takes place.

I myself for ten years have been endeavoring to illustrate by graphs and to establish numerically the growth of the jaws in man. My method naturally cannot be experimental; it must needs be purely biometric. The same individual's jaws are periodically measured, the study being thus extended over a steadily pro-

*A paper presented before the Second International Orthodontic Congress, London, 1931.

longed series of year. However, I am not satisfied with seeking the measurements of the dental arch, such as J. Sim Wallace has recently been able to publish; my method of measuring furnishes the data needed to establish with accuracy the correlation of the growth of the jaws with the main facial points, especially the profile. It must be noticed that the measurements are not taken with calipers only, as is customary in anthropology; my method claims to obtain much more accurate results. When we take a plaster impression of the maxilla, the impression tray will grip the toothed jaw perfectly tightly and firmly. If, then, we succeed further in adjusting on the impression tray a measuring apparatus so securely as to prevent any sort of play and enable us to find its bearings to any facial point required, we shall attain the highest degree of accuracy possible.

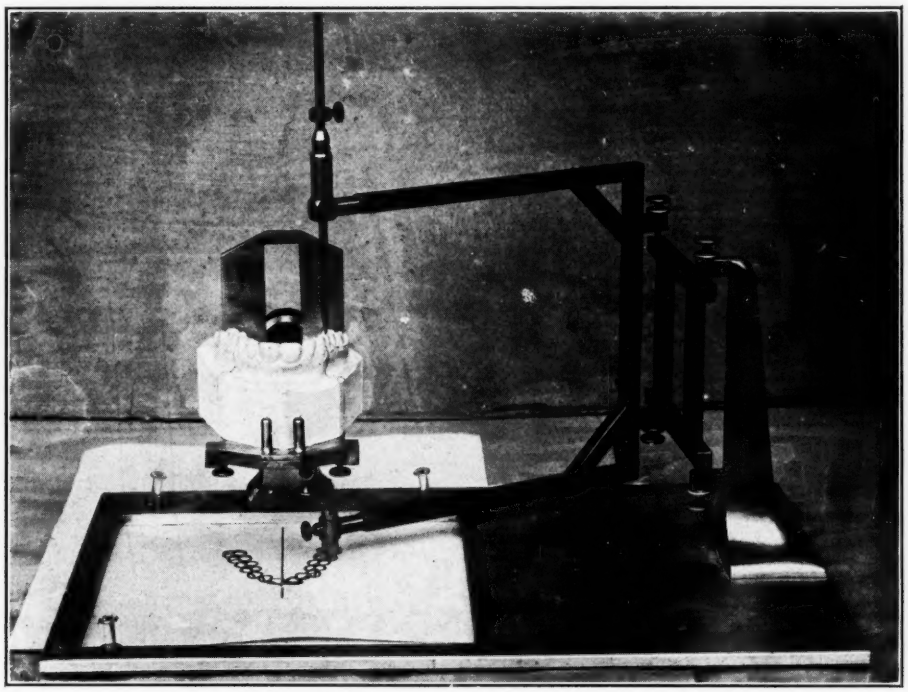


Fig. 2.—The stereograph.

With the aid of some fine screw points the face points are found and marked on the plaster cast (Fig. 1); the transfer to the drawing is done with the aid of my small stereograph, also with the greatest accuracy (Fig. 2). The three-dimensional drawings are directed on the ear eye plane, and the only measurements used are the distances projected on this plane, so that the measurements in height, width, and length cannot interfere with one another. I make only two diagrams:

(1) The projection on the median sagittal plane (raphe median plane).

(2) The projection on the horizontal plane in correspondence with the position of the ear eye plane.

We know that there are not any absolutely invariable points in the head. The longitudinal growth of the face we can most conveniently measure in rela-

tion to the bitragial line, which corresponds with the biporial axis of the cranium. The material from my examinations is mainly concerned with orthodontic cases, that is to say, with jaws more or less deformed. For comparison I present one normal jaw, the serial measuring of which, however, did not begin until the age of seven years. My earliest measurements are on children of four years. Fig. 3 shows a drawing of a head on which the various measurements employed are indicated.

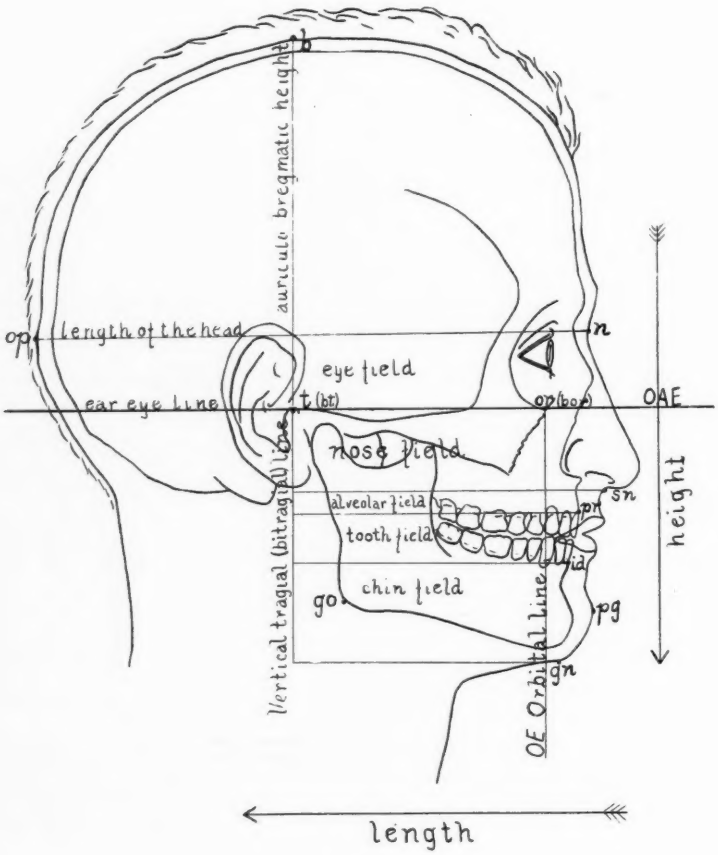


Fig. 3.

To begin with, let us trace the growth of the head between the ages of four and seven years in two children on whom at that period no orthodontic treatment took place.

CASE 1. The patient is a boy. The examination at the age of four years revealed a distoclusion with maxillary retrusion; at the age of seven years the front teeth had been replaced, the first molars had fully erupted, and the maxillary retrusion had been transformed into a protrusion. (Figs. 4-6.)

The drawings permit all the alterations to be read off at a glance.

I have observed in still another instance the transformation of retrusion of the maxillary front teeth in the deciduous dentition into a protrusion. Fig. 7 shows the models taken at six years and at nine years respectively.

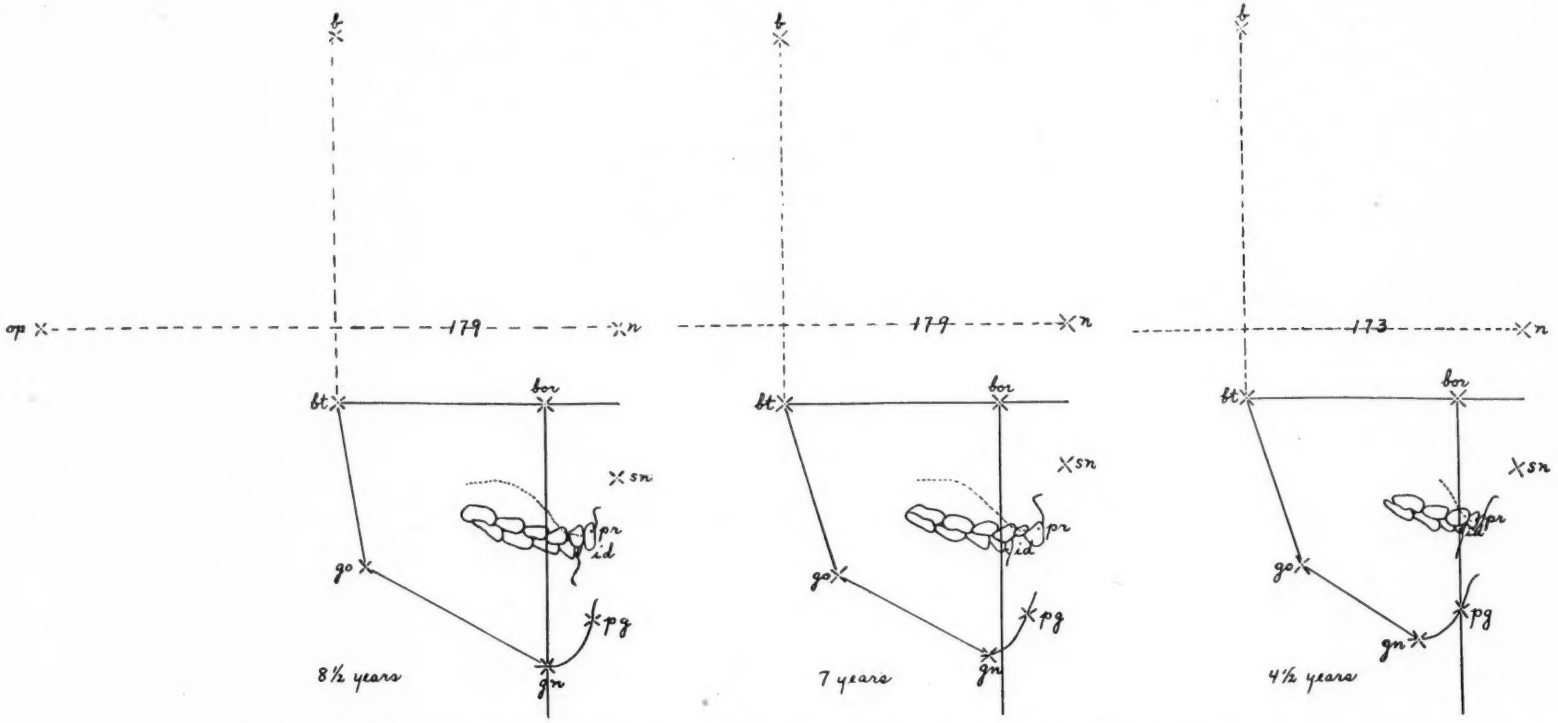


Fig. 4.—Case 1. Projection on the median sagittal plane (raphe median plane).

KEY

b—Bregma, is erected perpendicular to the bitragial point in these diagrams.
bor—Biorbitale, the intersection of the orbital line with the raphe median line.
bt—Bitragial point, middle of the bitragial (or biporial, or biauricular) distance (t-t).
gn—Gnathion, lowest point of the chin.
go—Gonion, mandibular angle point.
id—Infradentale, the interdental papilla between the mandibular central incisors.
n—Nasion, nasion point, the crossing point of the nasofrontal suture and the median sagittal plane.
OAE—ear eye plane, Frankfort plane.
OE—Orbital plane.
op—Opisthocranium, the most posterior point of the head.
or—Orbitale, the deepest point of the lower margin of the orbit.
pg—Pogonion, the most prominent point of the anterior chin relief.
pr—Prosthion, the interdental papilla between the maxillary central incisors.
sn—Subnasale, subnasal point.
t—Tragion, basis point of the tragus.

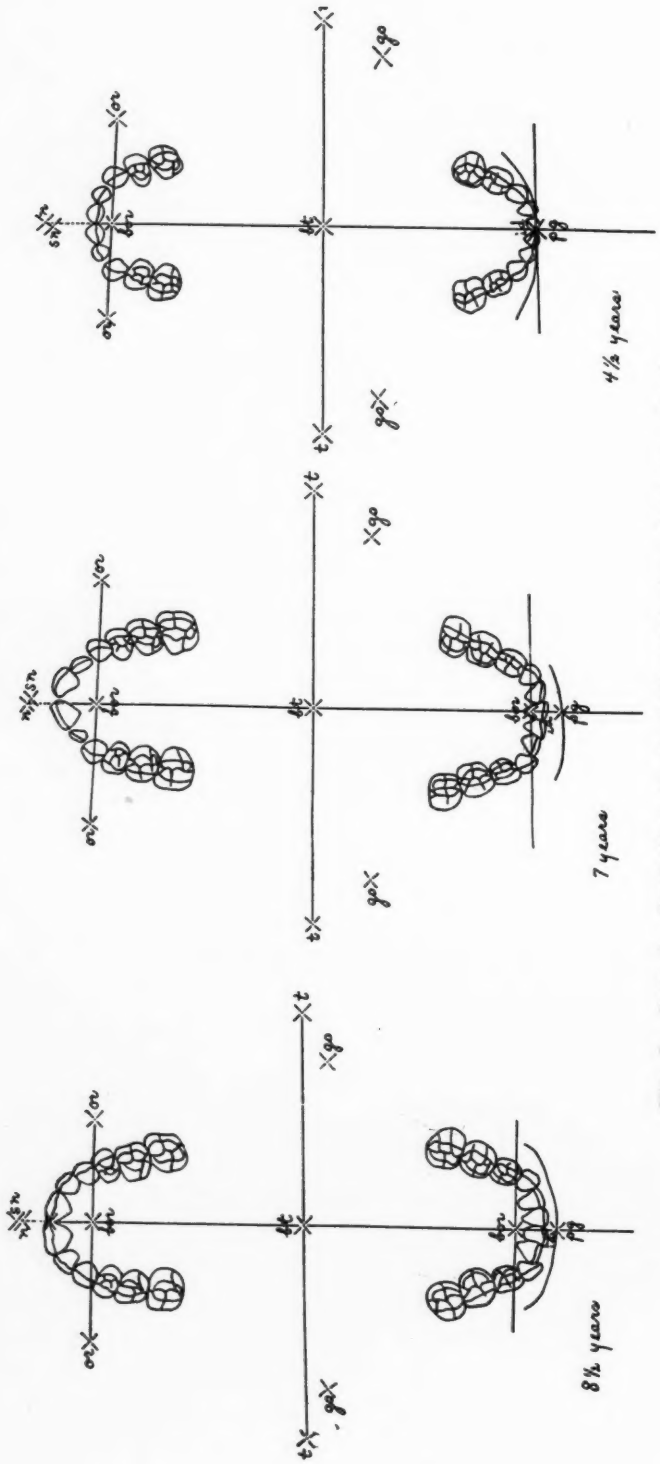


Fig. 5.—Case 1. Projection on the horizontal plane (ear eye plane).

TABLE I* (CASE 1)

HEIGHT

NO.	AGE	ANGLE CLASS	N OAE	N PR	N GN	SN OAE	SN PR	PR OAE	ID OAE	ID PR	ID GN	GN OAE	DECIDUOUS M 2 OAE	B OAE	PALATE
276	4	II²	22	61.5	100	22.5	17.5	39.5	40.5	1	37.5	78	32	118	–
431	7	II¹	25	66	106	20	21	41	49	7	34	81	37	117	9
Increase	4-7		3	4.5	6	–2.5	3.5	1.5	8.5	6	–3.5	3	5	–1	–
515	8½		24	65	109	24	17	41	48	7	37	85	37	118	9

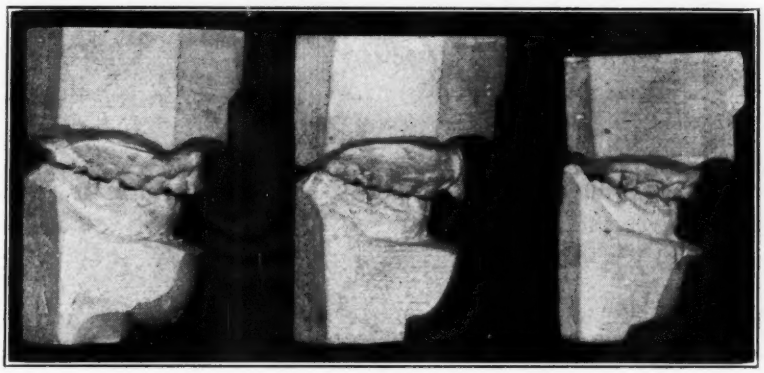
LENGTH

NO.	BOR BT	N BOR	N BT	N OP	SN BOR	SN BT	PR BOR	PR BT	ID BOR	ID BT	GN BOR	GN BT	DECIDUOUS M 2 BT	PG BOR	PG BT
276	64	20	84	173	17.5	81.5	5	69	–1	63	–12	52	43.5	0	64
431	66	21	87	179	20	86	12	78	1	67	–4	62	48	9	75
Increase	2	1	3	6	2.5	4.5	7	9	2	4	8	10	4.5	9	11
515	64	23	87	179	22	86	13	77	9	73	0	64	49	13	77

WIDTH

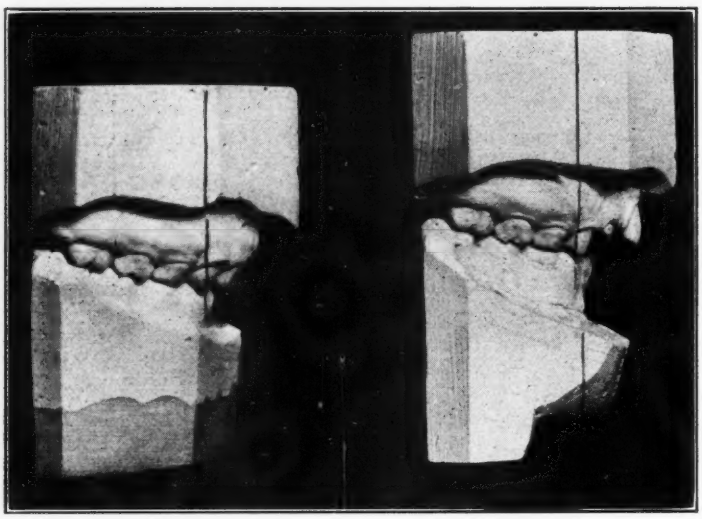
NO.	T - T	GO - GO	ORIFICE	DECIDUOUS MOLAR	INTER-MAXILLARE	PROFILE ANGLE
276	121	100	36	45	21.5	104°
431	126	100	39	47	25	98°
Increase	5	0	3	2	3.5	–6°
515	124	96	42	47	29	99°

*A key to the abbreviations used in the tables and diagrams is to be found under Fig. 4.



A *B* *C*

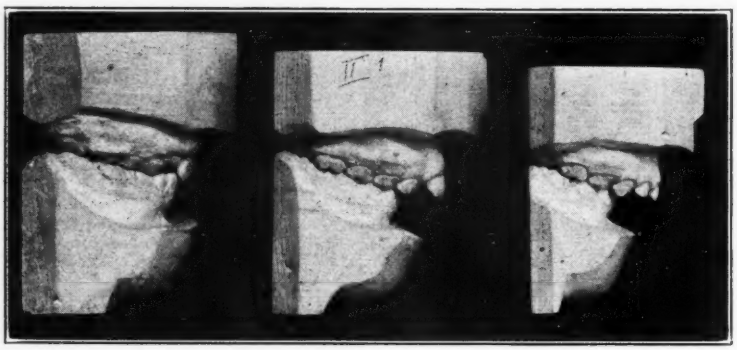
Fig. 6.—Case 1. *A*, eight years; *B*, seven years; *C*, four years.



A *B*

Fig. 7.—*A*, six years, retrusion; *B*, nine years, protrusion.

Case 2. The second examination was of a girl between the ages of four and seven years. Findings at four years six months were distoclusion Angle Class II, Division 1, strongly marked maxillary protrusion.



A *B* *C*

Fig. 8.—Case 2. *A*, eight years; *B*, seven years; *C*, four and one-half years.

At seven years the maxillary central incisors and all four mandibular incisors, also the first molars had erupted; distoclusion with maxillary protrusion. (Figs. 8-10.)

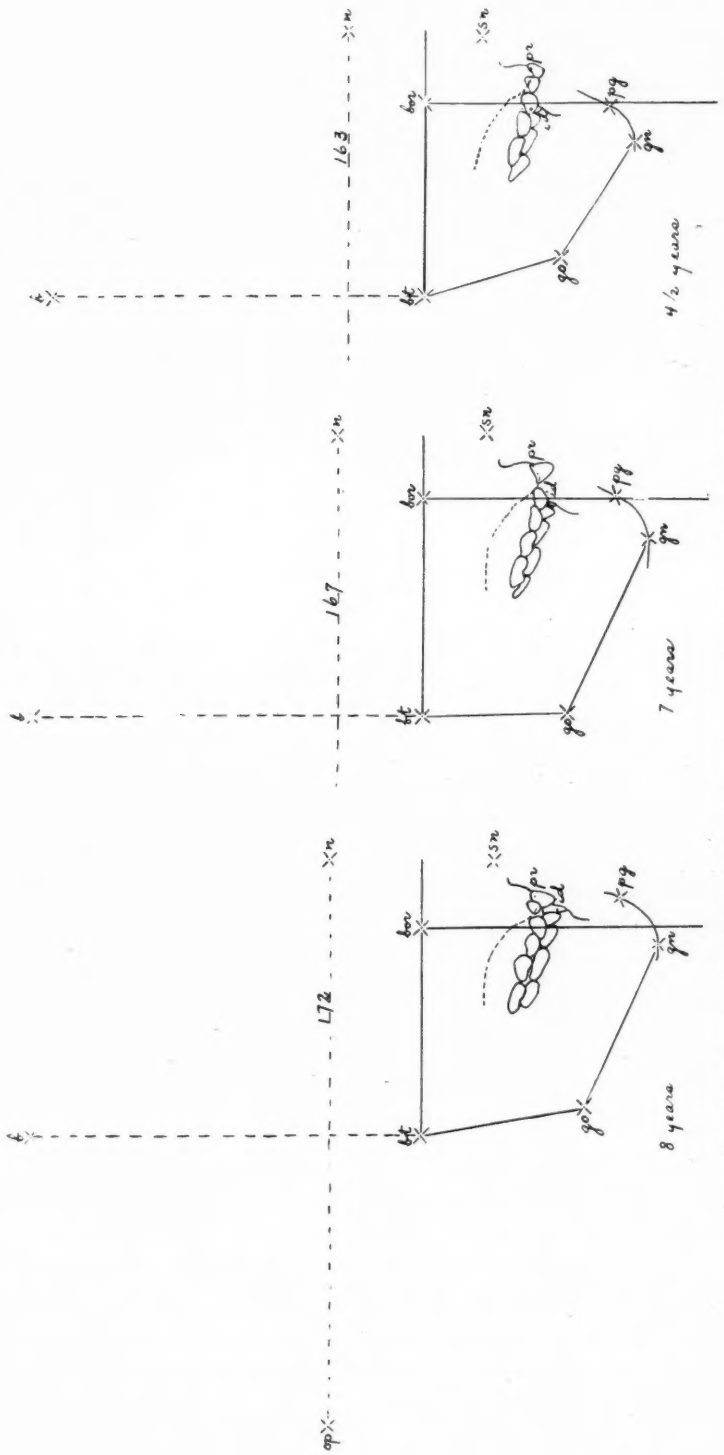


Fig. 9.—Case 2. Projection on the median sagittal plane (raphe median plane).

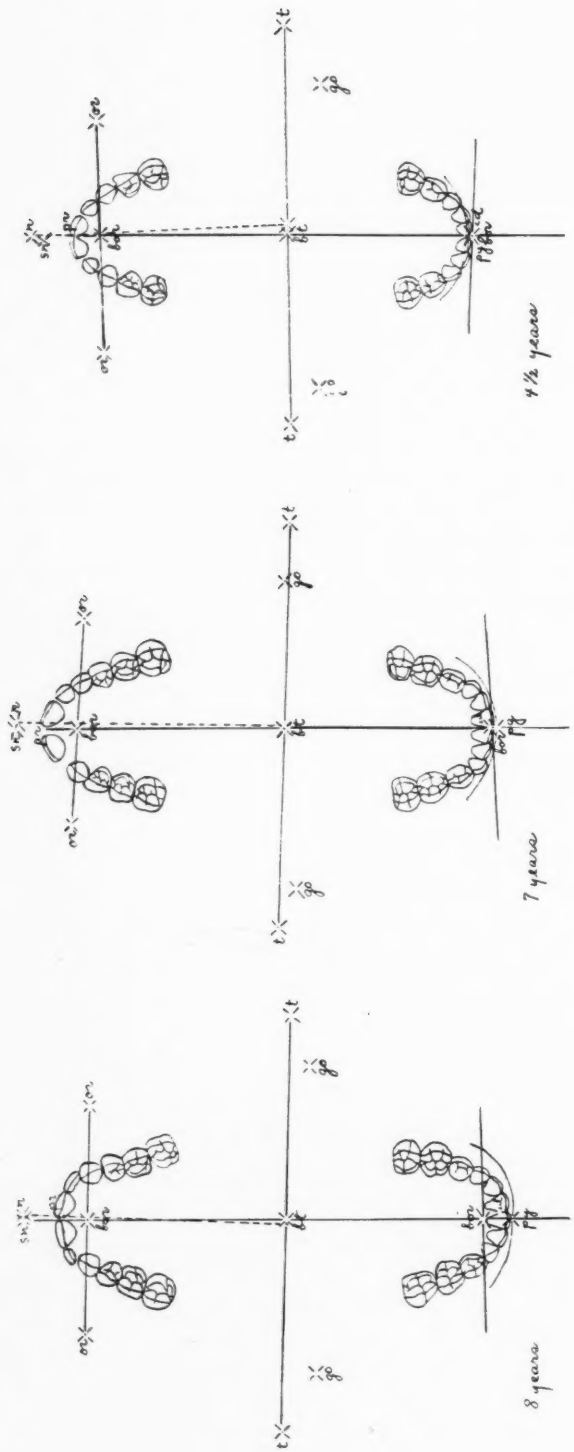


Fig. 10.—Case 2. Projection on the horizontal plane (ear eye plane).

TABLE II (CASE 2)

HEIGHT

NO.	AGE	ANGLE CLASS	N OAE	N PR	N GN	SN OAE	SN PR	PR OAE	ID OAE	ID PR	ID GN	GN OAE	DECIDUOUS M 2 OAE	B OAE	PALATE
219	4	II¹	24	57.5	90	19	14.5	33.5	33	–0.5	33	66	27	117	10
384	7	II¹	27	62	100	20	15	35	41	6	32	73	32	123	12
Increase	4-7		3	4.5	10	1	0.5	1.5	8	6.5	–1	7	5	6	2
463	8		29	66	105	23	14	37	45	8	31	76	32	123	12

LENGTH

NO.	BOR BT	N BOR	N BT	N OP	SN BOR	SN BT	PR BOR	PR BT	ID BOR	ID BT	GN BOR	GN BT	DECIDUOUS M 2 BT	PG BOR	PG BT
219	59	22	81	163	20	79	10	69	–1	58	–12	50	41	0	59
384	66	19	85	167	20	86	10	76	–2	63	–12	52	48	1	67
Increase	7	–3	4	4	0	7	0	7	–1	5	–2	2	7	1	8
463	63	20	83	172	20	83	10	72	4	68	–5	58	46	10	73

WIDTH

NO.	T - T	GO - GO	ORIFICE	DECIDUOUS MOLAR	INTER-MAXILLARE	PROFILE ANGLE
219	121	92	34	44.5	22	103°
384	124	94	37	46	26	99°
Increase	3	2	3	1.5	4	–4°
463	128	94	40	46	28	99°

CASE 3. A girl from five and one-half years to ten years, without any orthodontic treatment.

Findings at the age of five and one-half years: normal occlusion (neutroclusion) but the distal of the second deciduous molars in line. In the maxilla there was a small diastema between the lateral incisor and the canine on both sides; in the mandible the front teeth were compressed.

At nine years: the first permanent molars stood in cusp-to-cusp contact; the permanent incisors in slight protrusion; the growth of the alveolar process of the right maxilla was exceedingly backward at the point of the second deciduous molar, which no longer met its antagonist, the interstice amounting to 3 mm. (Figs. 11-13.)

With the last measurement at eleven years, the second right premolar had erupted and the alveolar border had increased 2 mm. in height.

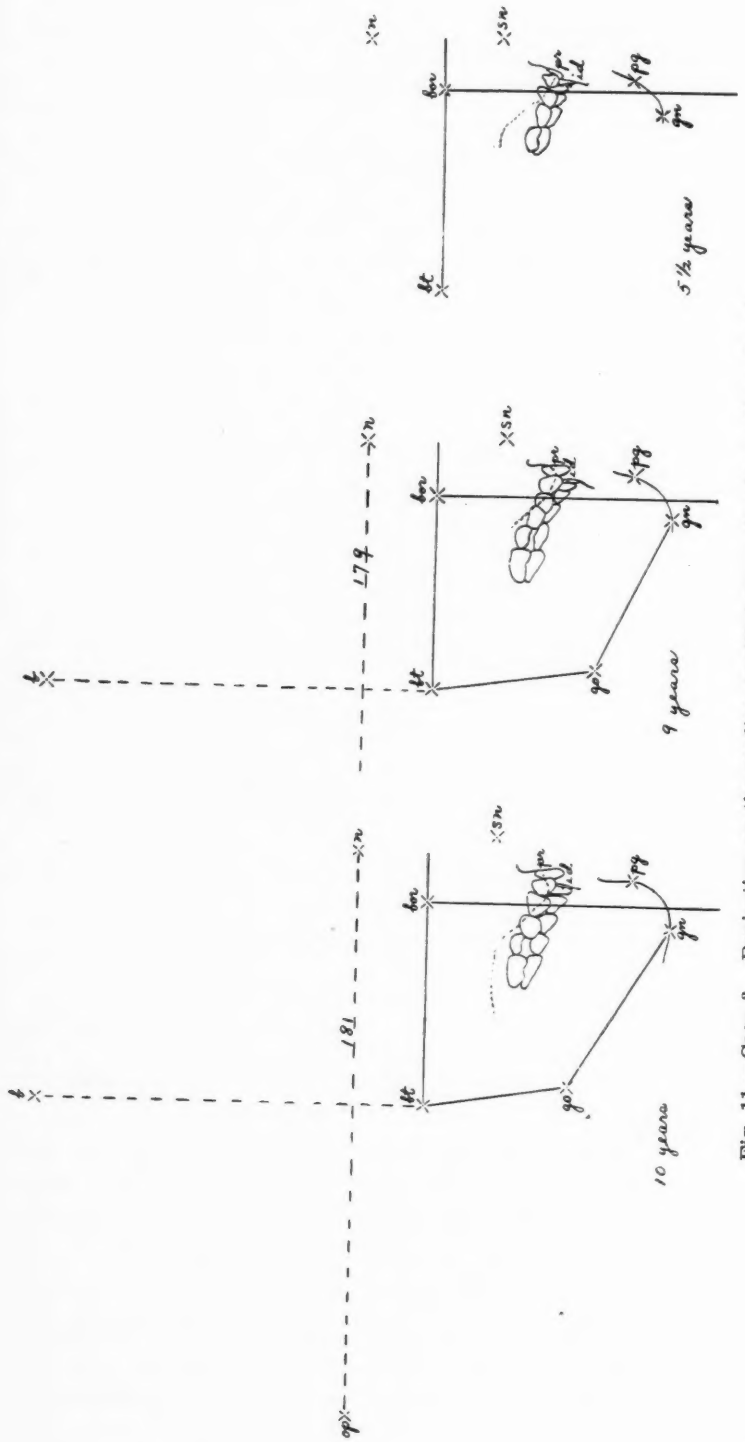


Fig. 11.—Case 3. Projection on the median sagittal plane (raphe median plane).

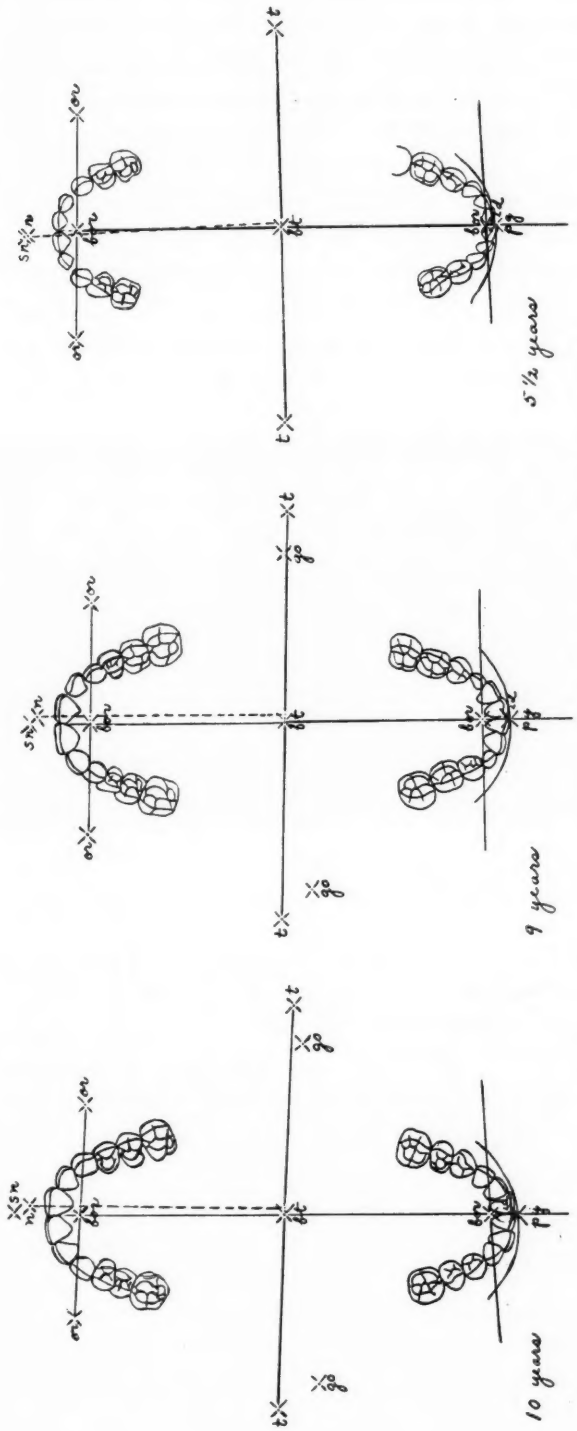
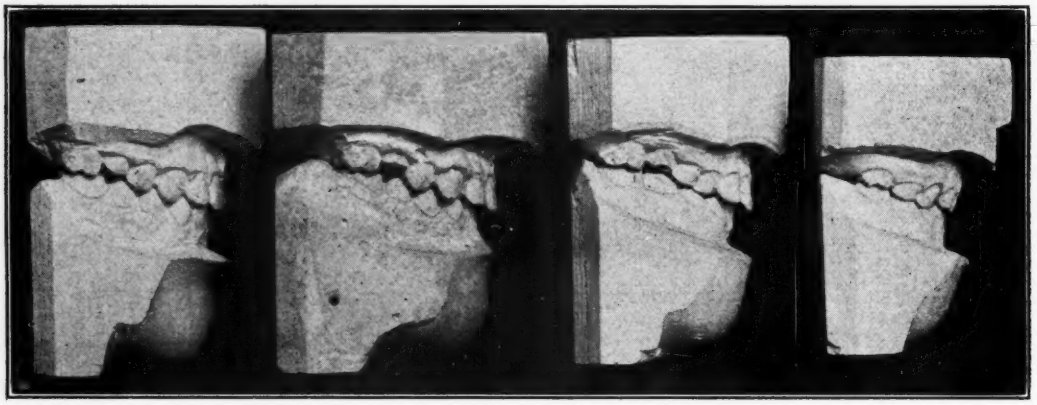


Fig. 12.—Case 3. Projection on the horizontal plane (ear eye plane).

With regard to the height measurements I wish to stress the great increase of the tooth height (tooth zone) in all three cases. In the two cases with distoclusion the increase is partly due to a resorption of the alveolar border in the mandible, for the height of the chin has decreased. The height of the alveolar process in the region of the molars increases faster then between the middle incisors, an observation which I have made previously and which has been confirmed by O. Meyer and J. Holst. The sagittal drawing shows particularly clearly how the roof of the palate had been lowered. The facts concerning the dimensions in length are most important. In the two distoclusion cases we find that the facial length has travelled in front of the basinasal length (*n-bt*); in the girl with neutroclusion this is not the case; the length of the face shows only a slight increase.

In the case of distoclusion which was transformed from a retrusion into a protrusion (1), the region of the increased growth lies in the section from the



A *B* *C* *D*

Fig. 13.—Case 3. *A*, eleven years; *B*, ten years; *C*, nine years; *D*, five years eight months.

prosthion to the orbital line (*pr-bor*), whereas in the second distoclusion with protrusion in the deciduous teeth the growth in length took place between the orbital line and the tragial line (*bor-bt*). The second deciduous molars, in the latter case moved forward by 10 mm. after the eruption of the first permanent molars; the advance in the other case of distoclusion (2), on the other hand, was only 3 mm. In the case of neutroclusion (3) the deciduous molars had not travelled forward at all.

The width of the deciduous molars, that is the transversal buccal distance from the left to the right deciduous molars in the maxilla, increased slightly in all three cases; the increase in the intermaxillary width was somewhat greater. It was particularly large in the neutroclusion, where it amounted to 8 mm. At the age of nine years, to be sure, all the permanent incisors were in their places; whereas in the two distoclusion cases at seven years only the central incisors had fully erupted.

A third measurement of the neutroclusion case (3) from the ages of nine to ten years revealed an accelerated growth in the lengths. The first molars had resumed their correct relative positions; the axis of the front teeth, however,

had been inclined forward, for the growth of the alveolar process had not kept pace; the cavities well known to all practitioners had been formed.

In the case of the first distoclusion (1) the orthodontic treatment was begun at the age of seven years. The measurements taken at the age of eight years six months gave the following result: the height of the chin had increased by 3 mm., that is to say, a great decrease in the seventh year was succeeded by a rapid increase at eight years and a half. As the tooth field had remained con-

TABLE III (CASE 3)

HEIGHT

NO.	AGE	ANGLE CLASS	N OAE	N PR	N GN	SN OAE	SN PR	PR OAE	ID OAE	ID PR	ID GN	GN OAE	DECIDUOUS M 2 OAE	B OAE	PALATE
184	5.8	I	24	59	95	19	16.5	35.5	41	5.5	30	71	29	–	10
405	9	I	23	61	101	23	15	38	44	6	34	78	29	126	7
Increase	5-9		–1	2	6	4	–1.5	2.5	3	0.5	4	7	0	–	–3
501	10		23	62	104	24	15	39	46	7	35	81	29	127	6

LENGTH

NO.	BOR BT	N BOR	N BT	N OP	SN BOR	SN BT	PR BOR	PR BT	ID BOR	ID BT	GN BOR	GN BT	DECIDUOUS M 2 BT	PG BOR	PG BT
184	64.5	16	80.5	–	16	80.5	6	70.5	2	66.5	–7	57.5	44	4	68.5
405	62	17	79	179	20	82	10	72	7	69	–6	56	46	8	70
Increase	–2.5	1	–1.5	–	4	1.5	4	1.5	5	2.5	1	–1.5	2	4	1.5
501	65	16	81	181	22	87	10	75	7	72	–5	60	49	9	74

WIDTH

NO.	T - T	GO - GO	ORIFICE	DECIDUOUS MOLAR	INTER-MAXILLARE	PROFILE ANGLE
184	121	–	–	49	22	102°
405	124	102	41	50	30	96.5°
Increase	3	–	–	1	8	–5.5°
501	124	104	44	50	29	95°

stant, new bone must be supposed to have been added at the lower border. The one dimension which it was possible to shorten by the application of orthodontic apparatus was the length of the face (*pr-bt*), whereas the basinasal length remained unchanged. The drawing forward of the mandible had caused all the dimensions to increase, especially the distance between the *infradentale* and the bitragial point; the base of the mandible with the gnathion had been rather backward.

In the case of the second distoclusion (2) the height of the chin, at the age of eight years, had decreased in favor of the height of the teeth. We are dealing with an undeveloped mandible. Through orthodontic treatment, which was begun at seven years, it was possible to shorten the facial length by 4 mm. The maxillary molars had remained fixed. The dimensions of the mandible likewise had greatly increased, this jaw having been drawn forward. The results of the measurements are supplemented by the Negocoll masks taken before and after the treatment. In so far as it can be ascertained, their measurements correspond exactly with the diagrams. (Fig. 14.)

Case 4. As a further instance I shall cite the case of a girl between the ages of seven years five months and thirteen years. Findings at seven years five months: distoclusion on the left side, gappy maxillary protrusion with

Fig. 14.—Negocoll mask taken before and after treatment (Case 2).

slightly open-bite. Orthodontic treatment was carried out for six months with the result that the maxillary central incisors met the mandibular ones correctly. The maxillary lateral incisors had not yet erupted at eight years six months. At this point the apparatus had to be removed on account of illness and absence. At thirteen years the findings were as follows: a slight maxillary protrusion, but without any gaps, had returned. The second premolars and the molars of the left mandible showed cross bite, which was the case already with the deciduous molars. (Figs. 15-17.) The measurements are given in Table IV.

We observe a considerable growth of the morphologic height of the face (*n-gn*), which is mainly due to the great increase of the height of the chin by 7 mm., all in spite of the fact that at eight years this dimension had decreased by 1 mm. I took the plaster profile from the first and the last jaw impressions. By superimposing the two diagrams we are enabled to see the exact alterations of the face within the space of five and one-half years. Particularly remarkable is the change of the form of the nose and the chin. The profile points of the face and prosthion have advanced at a fairly equal rate. (Fig. 18.)

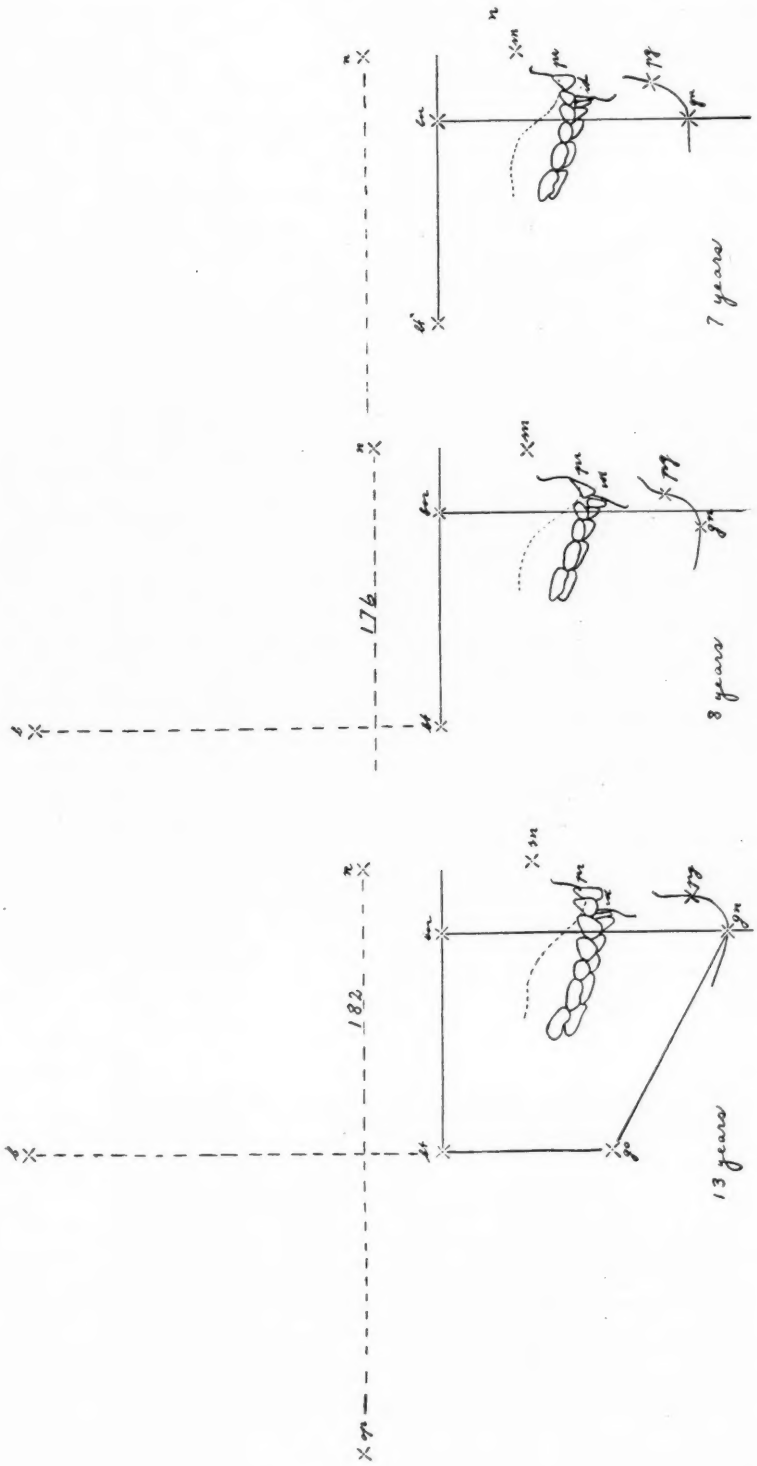


Fig. 15.—Case 4. Projection on the median sagittal plane (raphe median plane).

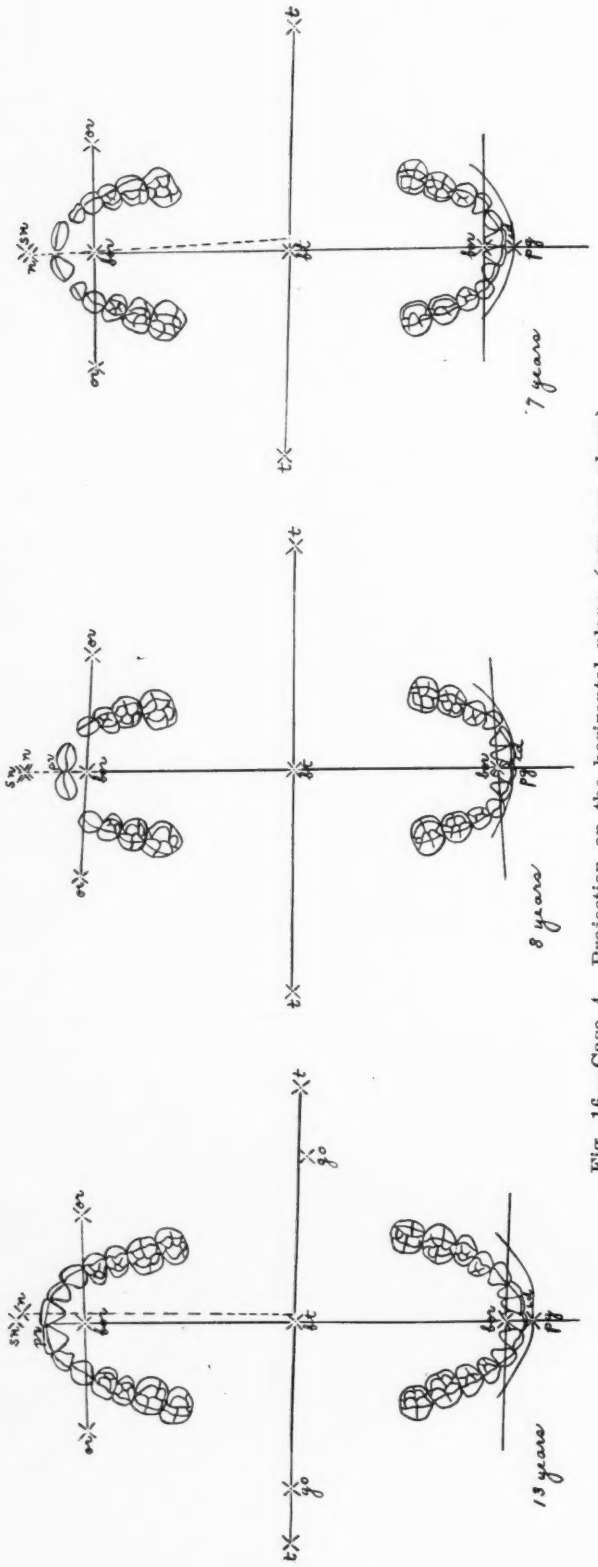


Fig. 16.—Case 4. Projection on the horizontal plane (ear eye plane).

TABLE IV (CASE 4)

HEIGHT

NO.	AGE	ANGLE CLASS	N OAE	N PR	N GN	SN OAE	SN PR	PR OAE	ID OAE	ID PR	ID GN	GN OAE	M 1 OAE	B OAE	PAL-ATE
146	7^5	$II^1{}_u$	23.5	61.5	103.5	24	14	38	48	10	32	80	33	–	8.5
224	8^5	$II^1{}_u$	21	66	104	28	17	45	52	7	31	83	35	130	10
Increase	7-8		–2.5	4.5	0.5	4	3	7	4	–3	–1	3	2	–	1.5
519	13		25	69	116	29	15	44	52	8	39	91	39	132	13

LENGTH

NO.	BOR BT	N BOR	N BT	N OP	SN BOR	SN BT	PR BOR	PR BT	ID BOR	ID BT	GN BOR	GN BT	M 1 BT	PG BOR	PG BT
146	61	20	81	–	20.5	81.5	12	73	6	67	0	61	36	11	72
224	66	20	86	176	19	85	7	73	4	70	–5	61	39	5	71
Increase	5	0	5	–	–1.5	3.5	–5	0	–2	3	–5	0	3	–6	–1
519	68	20	88	182	22	90	13	81	6	74	–1	67	46	10	78

WIDTH

NO.	T - T	GO - GO	ORIFICE	MOLAR	INTER-MAXILLARE	PROFILE ANGLE
146	133	–	40	53	28.5	98°
224	138	–	43	52	27	101°
Increase	5	–	3	–1	–0.5	3°
519	140	102	44	54	26	96°

A *B* *C*

Fig. 17.—Case 4. *A*, thirteen years; *B*, eight years five months; *C*, seven years five months.

Case 5. For comparison let us now examine a normal jaw of a boy of Swiss nationality, between the ages of seven years and twelve years two months, in normal conditions (neutroclusion).

Findings at seven years: in the maxilla the central permanent incisors and the first molars had erupted. The deciduous molars on the right side were carious. In the mandible all the permanent incisors had appeared, rather closely ranged, and the first molars; the deciduous molars on the left had already been extracted, as had also the second molar on the right.

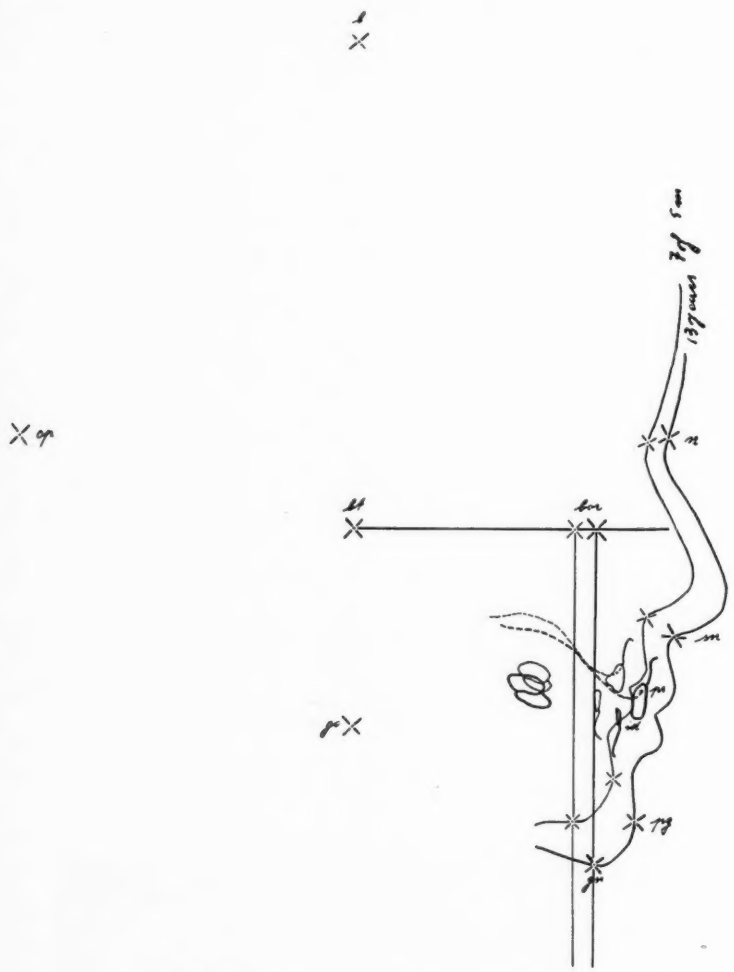


Fig. 18.—Case 4. Plaster profiles.

Findings at nine years: in the maxilla the permanent incisors were in their places; from a slightly protruding position they had become erect. On the left the deciduous canine and molars were still in place, on the right they had been shed; the first premolar, which had erupted, had advanced somewhat. In the mandible the first molars and all the incisors were in place; the canine on the left was just breaking through; all the deciduous canines and molars had been shed, in consequence of which there was to be observed a slight tilt in the left first molar.

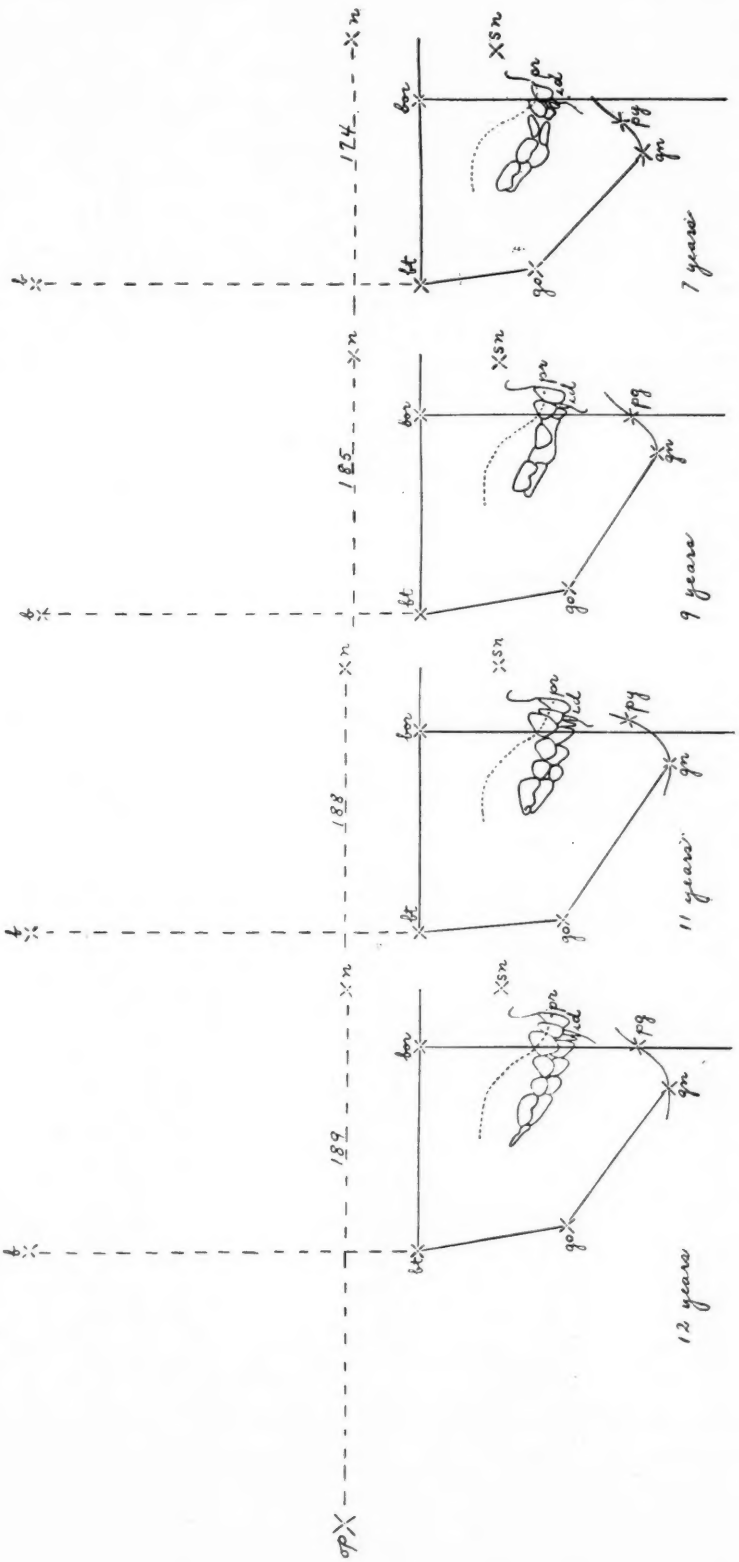


Fig. 19.—Case 5. Projection on the median sagittal plane (raphe median plane).

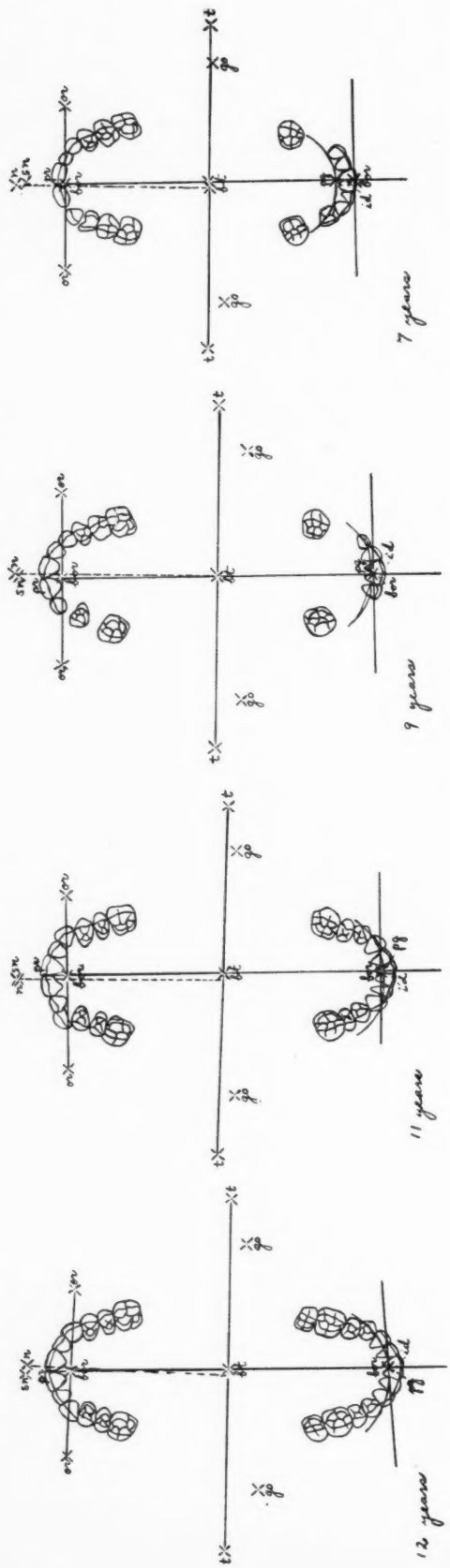


Fig. 20.—Case 5. Projection on the horizontal plane (ear eye plane).

Findings at eleven years: permanent teeth up to the first molars. The right maxillary canine stood slightly labially, because the advanced premolar had narrowed the gap. That it should automatically move into line on the dental arch seemed out of the question. The right mandibular premolar was likewise badly pinched.

TABLE V (CASE 5)

HEIGHT

NO.	AGE	ANGLE CLASS	N OAE	N PR	N GN	SN OAE	SN PR	PR OAE	ID OAE	ID PR	ID GN	GN OAE	M 1 OAE	B OAE	PAL-ATE
218	7	I	22	61	95.5	25.5	13.5	39	46	7	27.5	73.5	27	126	10
356	9	I	22	63	100	26	15	41	49	8	29	78	32	124	10
Increase	7-9		0	2	4.5	0.5	1.5	2	3	1	1.5	4.5	5	–2	0
516	11	I	25	69	108	26	18	44	50	6	33	83	34	128	13
568	12[2]	I	24	68	107	27	17	44	51	7	32	83	34	128	13

LENGTH

NO.	BOR BT	N BOR	N BT	N OP	SN BOR	SN BT	PR BOR	PR BT	ID BOR	ID BT	GN BOR	GN BT	M 1 BT	PG BOR	PG BT
218	59	20	79	174	16	75	4	63	–2	57	–18	41	30	–6	53
356	63.5	19	82.5	185	17.5	81	8	71.5	3	66.5	–13	50.5	37.5	0	63.5
Increase	4.5	–1	3.5	11	1.5	6	4	8.5	5	9.5	5	9.5	7.5	6	10.5
516	64	20	84	188	22	86	9	73	4	68	–11	53	40	2	66
568	65	18	83	189	18.5	84	10	75	3.5	68.5	–13	52	39.5	0	65

WIDTH

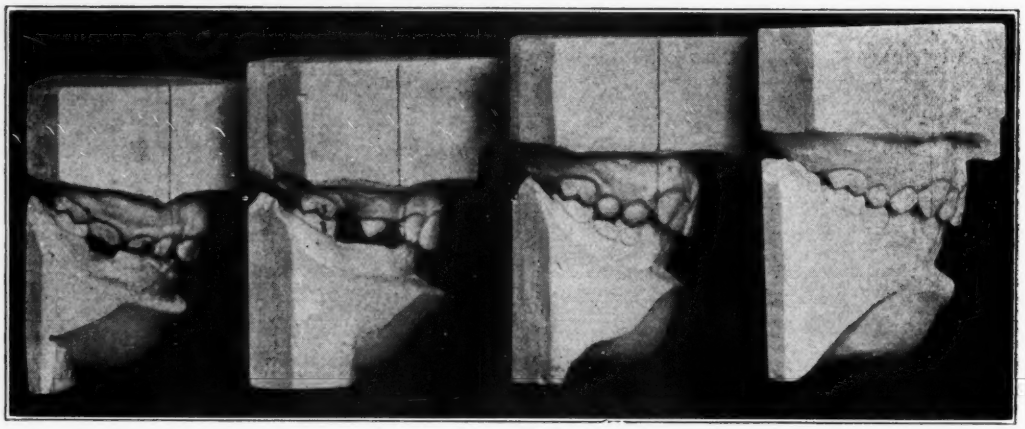
NO.	T - T	GO - GO	ORIFICE	MOLAR	INTER-MAXILLARE	PROFILE ANGLE
218	132	–	40	52	24	104°
356	138	100	40	54	28	100°
Increase	6	–	–	2	4	–4°
516	140	98	42	55	28	99°
568	144	100	43	56	28	98°

Findings at twelve years two months: in the mandible the second molars had erupted. The maxillary right canine had corrected its lack of space and now stood in the correct place in the dental arch. Also the second premolar on the left had fully broken through. (Figs. 19-22.)

With regard to the dimensions we observe, contrary to the preceding case, a considerable advance of the prosthion over the nasion (difference 8 mm.), one-

half of the gain in growth being due to the distance from the prosthion to the orbital plane. It is this energy of growth in this section that has brought about the automatic correction of an anomalous position.

For the purpose of studying the after effects of an extraction which was made with a view to correcting a jaw anomaly, I propose to show two cases in the course of a few years.



A *B* *C* *D*

Fig. 21.—Case 5. *A*, seven years; *B*, nine years; *C*, eleven years; *D*, twelve years.

A *B* *C* *D* *E*

Fig. 22.—Case 5. *A*, twelve years; *B*, eleven years; *C*, nine years; *D*, seven years; *E*, four and one-half years.

Case 6. A girl of twelve years. Findings: distoclusion, Angle Class II, Division 1; protrusion in the maxilla; the orbital line falls behind the canines; protrusion.

At thirteen years the first premolars in the maxilla were extracted and orthodontic treatment was begun. At fourteen years eleven months a good occlusion of the maxillary and mandibular front teeth had been attained, without any displacement of the distoclusion occurring. A reexamination at the age of eighteen years showed a somewhat more oblique position of the axis of the front teeth; otherwise the occlusion was satisfactory. Table VI and Figs. 23 and 24 will demonstrate the changes of relative positions caused by growth. (Figs. 23-25.)

It is important to establish whether the tendency to growth forward in the maxilla can be stopped by an extraction. Although the maxillary front teeth had been pressed inward, the prosthion within a year eleven months had been

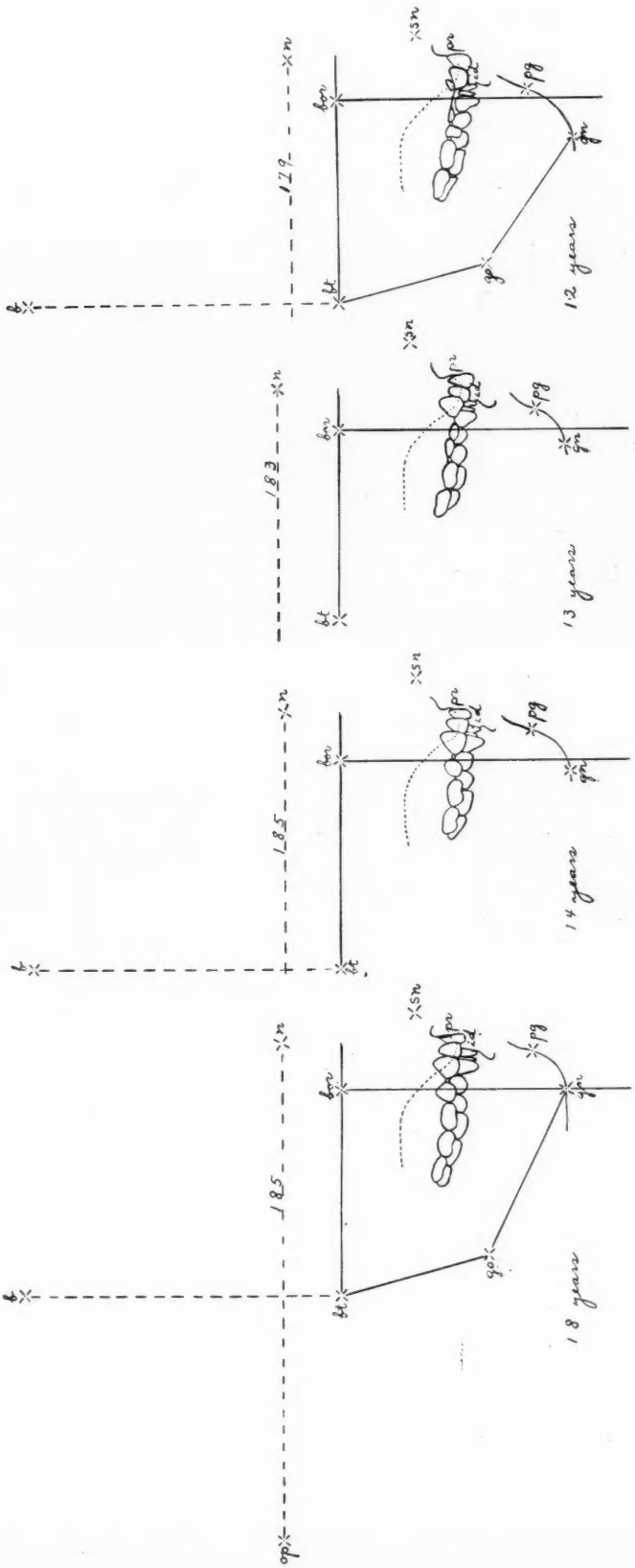


Fig. 23.—Case 6. Projection on the median sagittal plane (raphe median plane).

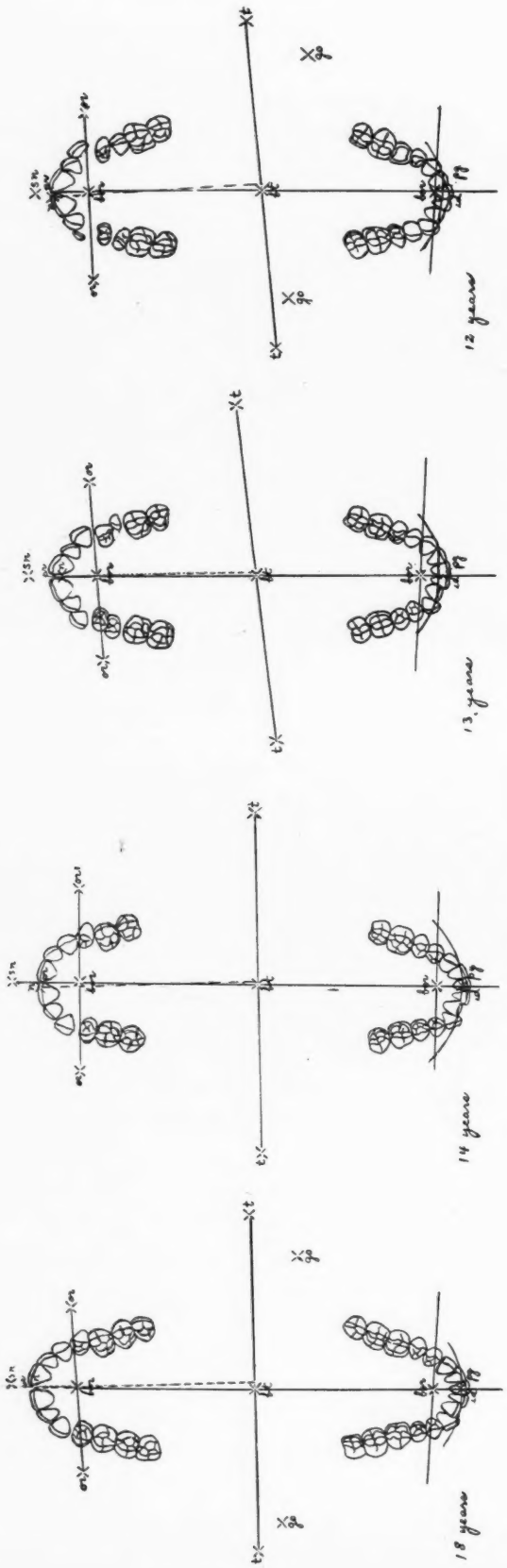
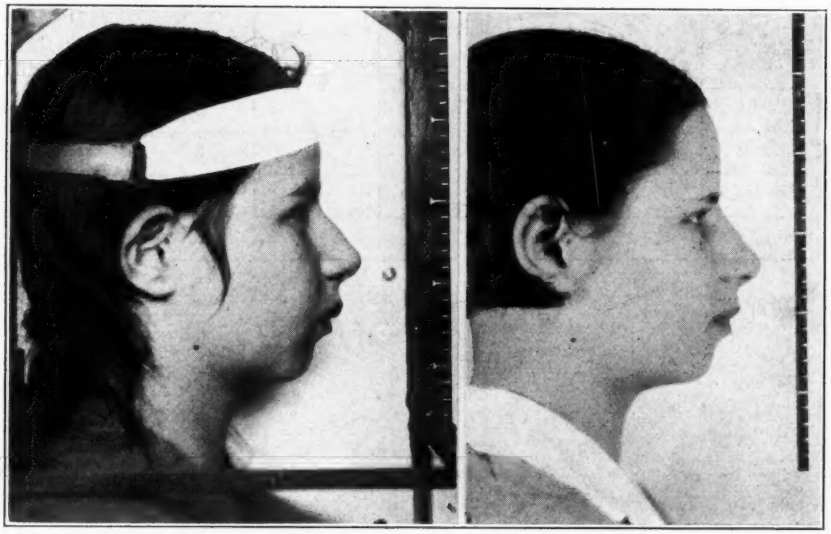


Fig. 24.—Case 6. Projection on the horizontal plane (ear eye plane).

carried forward by 4.5 mm. from the ear axis; this growth was equal in magnitude to that of the cranium axis (*n-bt*). We thus need no longer fear lest the maxilla should advance, the less so as the dimensions of the mandible have increased far more.

A *B*

Fig. 25.—Case 6. *A*, twelve years; *B*, fourteen years eleven months.



A *B*

Fig. 26.—Case 6. *A*, twelve and one-half years; *B*, eighteen years.

From the age of fourteen to eighteen years the dimensions had increased but little. Even though in this particular case it was not possible to arrest the forward growth of the maxilla, owing to an inherent racial peculiarity and a powerful energy of growth in the subnasal parts (Fig. 26), I have succeeded in two other cases in reducing permanently the distance from the prosthion to the ear axis. In a girl of nineteen years, whose treatment was concluded at

TABLE VI (CASE 6)

HEIGHT

NO.	AGE	ANGLE CLASS	N OAE	N PR	N GN	SN OAE	SN PR	PR OAE	ID OAE	ID PR	ID GN	GN OAE	M 1 OAE	B OAE	PAL-ATE
81	12	II¹	18	62	107	30	14	44	51	7	38	89	40	118	15.5
263	14¹¹	II¹	21	65	109	29	15	44	51	7	37	88	42	117	18
Increase	12-14		3	3	2	–1	1	0	0	0	–1	–1	2	–1	2.5
512	18¹⁰		22.5	64.5	108.5	29	13	43	50	8	36	86	40	120	18

LENGTH

NO.	BOR BT	N BOR	N BT	N OP	SN BOR	SN BT	PR BOR	PR BT	ID BOR	ID BT	GN BOR	GN BT	M 1 BT	PG BOR	PG BT
81	74	15	89	179	23	97	14.5	88.5	5.5	79.5	–14	60	50	2.5	76.5
263	76	17.5	93.5	185	30	106	17	93	12	88	–4	68	59	11	87
Increase	2	2.5	4.5	6	7	9	2.5	4.5	6.5	8.5	10	8	9	8.5	10.5
512	75	17	92	183	28	103	19	94	14	89	0	75	62	13	88

WIDTH

NO.	T - T	GO - GO	ORIFICE	MOLAR	INTER-MAXILLARE	PROFILE ANGLE
81	138	102	42	55	29	91°
263	141	109	47	53	30	91°
Increase	3	7	5	–2	1	0
512	142	112	50	52	29	88°

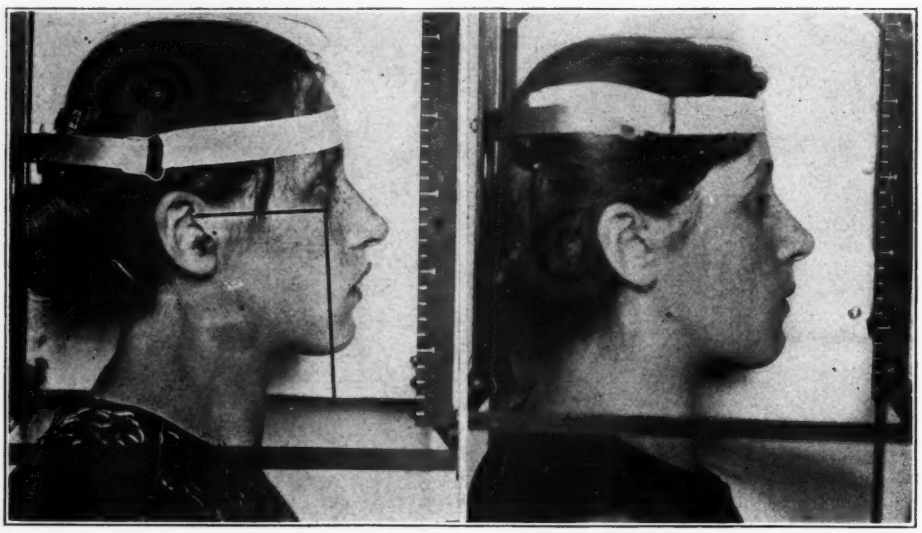


Fig. 27.—Before and after treatment.

twenty years of age, the measurements taken at twenty-six years five months showed a distance still reduced by 5 mm. The badly decayed first molars were sacrificed (Fig. 27).

Case 7. Another correction by means of extraction in a girl of sixteen and one-half years also brought about a permanent shortening of the maxilla by 4 mm. The first premolar on the left and the second on the right were extracted.

Findings at sixteen years six months: distoclusion with closely ranged protrusion in the maxilla.

Table VII (Case 7)

Height

NO.	AGE	ANGLE CLASS	N OAE	N PR	N GN	SN OAE	SN PR	PR OAE	ID OAE	ID PR	ID GN	GN OAE	M 1 OAE	B OAE	PAL-ATE
171	16½	II¹	25	66	107	26	15	41	45	4	37	82	38	–	13
258	17	II¹	26.5	67.5	108.5	25	15	41	46	5	35	82	38	–	13
Increase	16-17		1.5	1.5	1.5	–1	0	0	1	1	–2	0	0	–	0
517	21		30	71	112	26	15	41	46	5	36	82	38	127	13

Length

NO.	BOR BT	N BOR	N BT	N OP	SN BOR	SN BT	PR BOR	PR BT	ID BOR	ID BT	GN BOR	GN BT	M 1 BT	PG BOR	PG BT
171	69	23	92	180	25.5	94.5	19	88	9	78	2	71	52	13	82
258	71	23	94	–	26	96	13	84	8	79	2	73	56	12.5	83
Increase	2	0	2	–	0.5	1.5	6	–4	1	1	0	2	4	–0.5	1
517	70	22	92	181	24	94	14	84	8	78	3	73	56	13	83

Width

NO.	T - T	GO - GO	ORIFICE	MOLAR	INTER-MAXILLARE	PROFILE ANGLE
171	136	–	48	56.5	29	94°
258	138	98.5	–	55	31	97°
Increase	2	–	–	–1.5	2	3°
517	137	104	53	54	31	97°

At seventeen years eight months: the protrusion had been cured by orthodontic treatment.

At twenty-one years nine months: the corrected position of the maxilla had not been altered. (Figs. 28-30.)

The facial height from the ear eye plane to the chin had remained unchanged. The length of the face (from *pr-bt*) had decreased by 4 mm. The

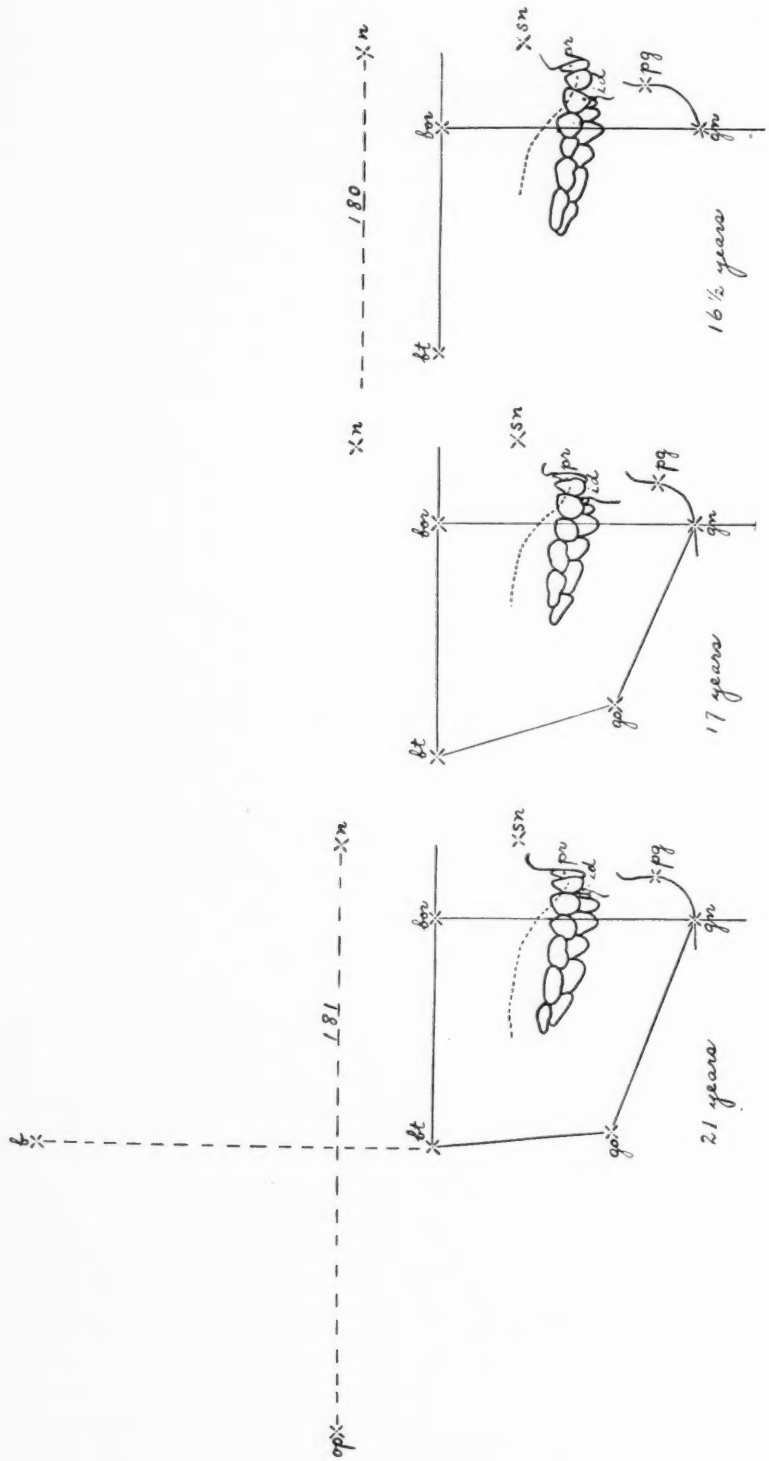


Fig. 28.—Case 7. Projection on the median sagittal plane (raphe median plane).

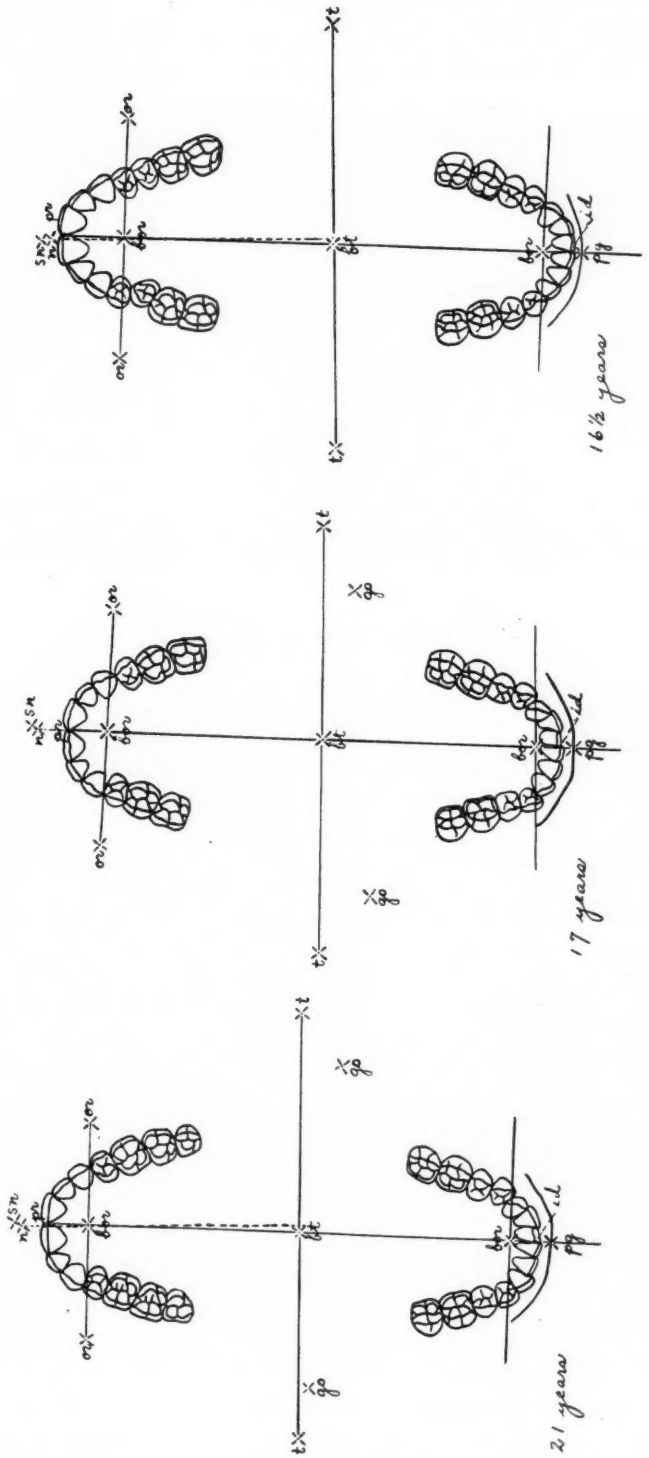
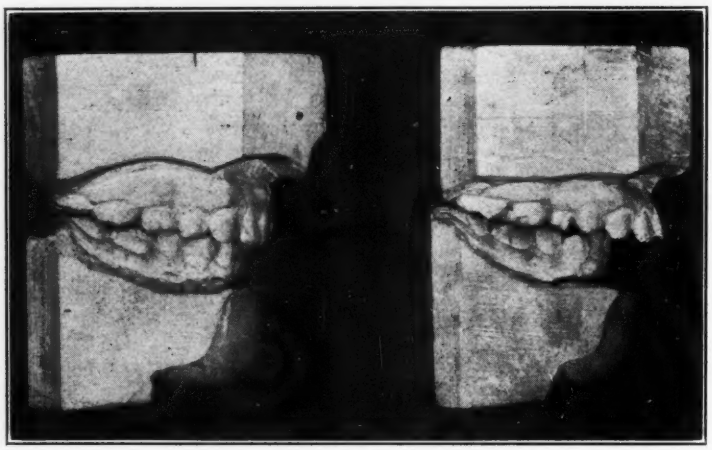


Fig. 29.—Case 7. Projection on the horizontal plane (ear eye plane).

position of the maxillary first molars had remained constant during an interval of four years after the extraction of the premolars. The great shortening of the dental arch may be noted on the drawings. If we superimpose the three plaster profiles of the various ages, we observe only a slight change of the contour of the nose and an improvement in the position of the lips. (Fig. 31.)



A *B*

Fig. 30.—Case 7. *A*, twenty-one years; *B*, sixteen and one-half years.

A *B*

Fig. 31.—Case 7. *A*, sixteen and one-half years; *B*, twenty-one years.

From a great number of individual measurements at my disposal I have selected these few cases in order to show how accurately the changes caused by growth in the jaws and face can be traced with the help of my cephalometric method. For ten years I have kept on improving the apparatus with the result that the highest possible degree of accuracy is now assured.

For the orthodontist these observations of individual cases extending over long periods of time are of the greatest importance, showing as they do in which

places and in what degree it is possible to stimulate by orthodontic apparatus the growth of the bones. A primary object of study consists in arranging into groups the existing material, either according to constitutional types or according to genetic criteria, as proposed by Korkhaus and A. Martin Schwarz. I

Fig. 32.

have already assembled a large amount of material according to Angle's system of classification and also computed after the generalizing method the averages of the orthodontic cases measured. Three hundred seventy-six cases have so far been dealt with completely. (Fig. 32.)

The particulars of my method have been explained in articles published in various journals. My practical demonstration will supply complete information. I should, therefore, ask you to defer for that occasion any points for discussion.

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A demonstration of cephalometric and craniometric apparatus was given by Dr. Rudolph Schwarz. The demonstration comprised:

1. The face bow with individual positions of the face points.

2. The direct transfer of these points on the plaster models. With the help of the small stereograph the plaster models are projected on three planes. The diagrams so obtained present the exact position of the jaw relative to the more important points of the face and head.

3. A further object of demonstration was the new model of the large stereograph "Schwarz" for the drawing of skulls, by means of which complete diagrams in all norms may be drawn.

RUSTLESS STEEL ORTHODONTIC APPLIANCES (WIPLA APPLIANCES)*

PROF. DR. PAUL W. SIMON, BERLIN, GERMANY

THE Wipla appliances are made of rustless steel wire, 0.6 mm. or 0.7 mm. thick for the main arches, and 0.4 or 0.5 mm. for the auxiliary springs. The appliances consist of labial and lingual wires and of the auxiliary springs. The molar bands to which they are attached are of precious metal or of Argentan, a sort of German silver. The operator may solder them, but they can also be purchased, manufactured in different sizes (Figs. 1 and 2).

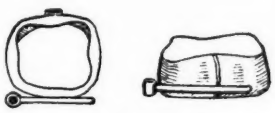


Fig. 1.

Fig. 2.

Fig. 1.—The fitted anchor band.
Fig. 2.—The clamp anchor band, which may be purchased already manufactured.

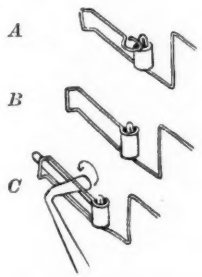


Fig. 3.—The buccal lock: *A*, before being shut; *B*, shut; *C*, before being opened.

Buccally they have a small vertical tube soldered on a wire, the end of which serves for the attachment of intermaxillary elastics and lingually a flat small tube for the lingual lock. One may thus, as it becomes necessary, exchange lingual and labial appliances without continually recementing the band. The labial and lingual arches are bent out of one piece of wire; nothing is soldered, even the lock is bent. The buccal lock consists of a recurved pin, a horizontal loop, and a small ring which springs over the pin (Fig. 3). The lingual lock consists of a pin and a small distal loop which springs against the band (Fig. 4).

The appliances most in use are the following:(1) the spring beam apparatus (Fig. 5), which consists of two lingual beams (Fig. 4 *A*), and the labial arch. The labial arch may be narrowed or enlarged or altered in its position by a quadrangular loop before the lock; for intermaxillary elastics it

*Demonstration presented at the Second International Orthodontic Congress, London, July, 1931.

is provided with a small hook in the region of the canines (Fig. 6). (2) The lingual arch and its modifications, the lingual arch has three quadrangular loops and lies close to the teeth (Figs. 7 and 8). A modification frequently used is the loop lingual arch, which has a loop for the incisors (Fig. 9). With

A *B*

Fig. 4.—The lingual lock, the distal loop springs against the band.

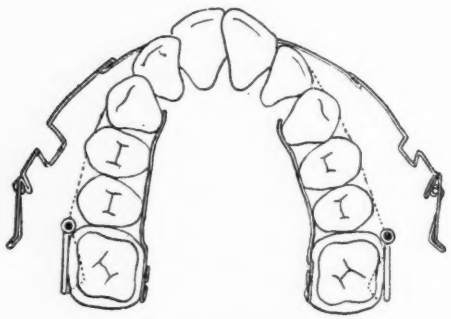


Fig. 5.—The spring beam apparatus.

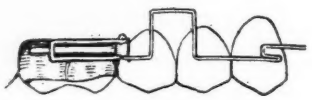


Fig. 6.—The labial arch, lateral view.

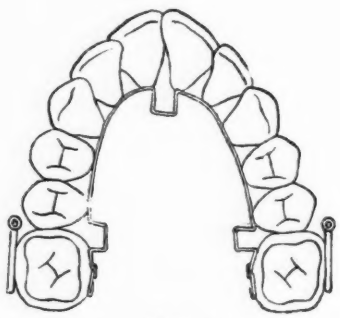


Fig. 7.

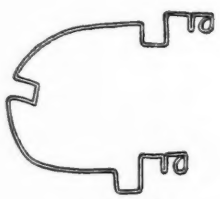


Fig. 8.

Figs. 7 and 8.—The lingual arch.

A *B* *C*

Fig. 9.—The loop lingual arch.

that loop one can (1) shorten the incisors, (2) bring them backward, (3) bring them forward, (4) move them to the left or right, and (5) bring them in line by pressing together loop and arch (Fig. 10). A tipping over of the anchor molars is prevented by a distal hook (Fig. 11).

The loop is soldered to the arch by soft solder as follows: the ends of the loop are wound three times around the arch and then soldered together with tin solder (without heating the arch) (Fig. 9 *A*). Auxiliary springs are firm-

Fig. 10.

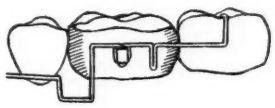


Fig. 11.—Distal hook.

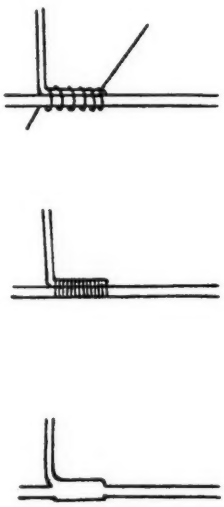


Fig. 12.—Soldering of Wipla with soft solder.

Fig. 13.—Auxiliary spring for the treatment of diastema, attached to the lingual arch.

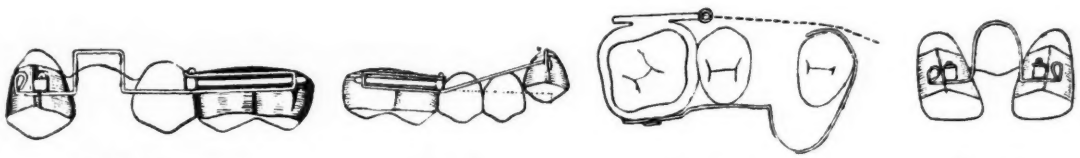


Fig. 14. Fig. 15. Fig. 16. Fig. 17.

Fig. 14.—Buccal spring for the distal movement of the canine.
Fig. 15.—Buccal spring for elongation of a canine.
Fig. 16.—Lingual spring for distal movement of a premolar.
Fig. 17.—Reciprocal spring for the treatment of a diastema.

ly bound to the arch before soldering by 0.1 mm. wire, then they are soldered in the same way (Fig. 12). The best thing to do is to use an electric soldering tool (Zwietusch, 10 RM) which heats up only to a certain degree, so that the arch will never be overheated and never lose its spring.

The auxiliary springs are either attached to the arches, as in Fig. 13, or directly attached to the locks as in Figs. 14-17.

There are many other interesting apparatus made of Wipla as shown in Figs. 18-21, but to describe them all would lead too much into detail.*

Very probably rustless steel will be the material of the future. For many

Fig. 18.—The lingual spring beam apparatus.

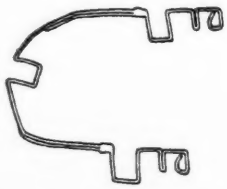


Fig. 19.—The beam lingual arch.

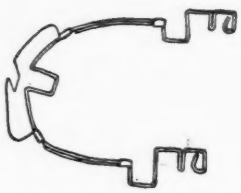


Fig. 20.—The beam and loop lingual arch.

Fig. 21.—The labiolingual arch.

reasons it is superior to all the other metals: (1) it never changes its color in the mouth; (2) the arches and springs very seldom break; (3) there is an enormous difference in price, an arch costs about one penny and the molar bands cost about six pence (the small flat tubes being of platinum are therefore the only expensive part of the Wipla appliances).

*A detailed description of the Wipla appliances has been published in Prof. Simon's book, Verlag Mensser, Berlin, from which the illustrations for this article are taken.

TYPES OF CHRONIC INFECTION ABOUT THE MOUTH*

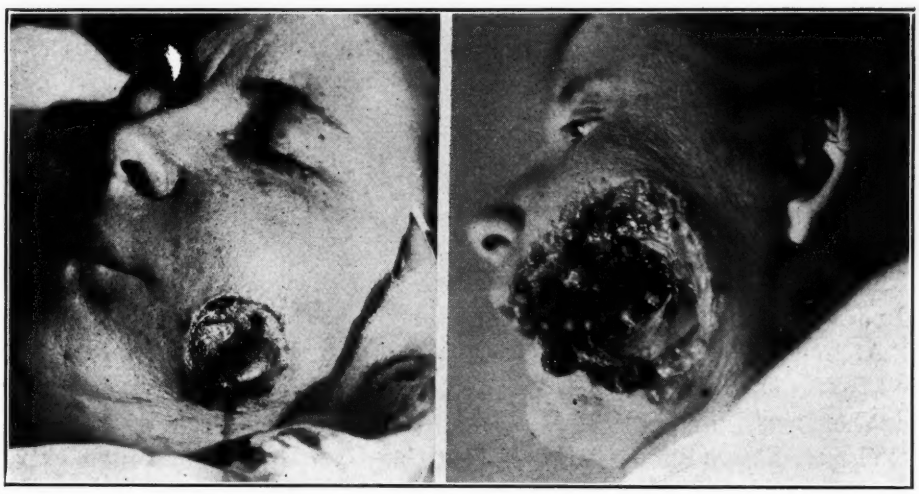
Report of Cases of Noma and of Acrodynia

James Barrett Brown, M.D., F.A.C.S., St. Louis, Mo.

(Continued from page 1315, December, 1932)

NOMA

THIS disease might be considered as being acute, but it might still better be considered a part of a disease process, because it occurs almost entirely in persons who are generally debilitated, as from some blood dyscrasia or infectious disease.



A *B*

Fig. 1.—*A* shows patient with perforation of cheek from noma originating on the buccal surface. *B* shows same patient fifteen days later just before death. This was a young woman who had borne several children and for many years had been debilitated by a bad rectovaginal fistula. Her general health and oral hygiene had been very bad, but no definite blood dyscrasia or other general disease was made out. Her extremely poor condition at time of entry to the hospital did not warrant any active local treatment. At autopsy 27 ulcers in the gastrointestinal tract were found, the etiology of which was not definitely established.

There is a progressive gangrene of the mouth usually originating in an indurated spot near the lips. The cheek may be perforated and the bone exposed; there is marked regional gland involvement, and death usually occurs in a few days from pneumonia or sepsis. In adults the disease is nearly always fatal; in children an estimate would be about 75 per cent.

The actual cause of the sloughing has not been definitely determined; although the B. fusiformis and spirochete that cause Vincent's infection have been shown invading the tissues.

*From the Service of Dr. V. P. Blair, Department of Surgery, Washington University School of Medicine, and the Oral Surgical Clinic, Washington University School of Dentistry, St. Louis.

The importance of the disease to the dentist is illustrated by one case we observed which followed the extraction of four mandibular teeth. There was failure of healing of the sockets for ten days, and then rapid perforation of the cheek and death. The patient was sent to the hospital a few days before death; no general examination had been previously made, and practically all the blame was on the dentist's shoulders. With only slight consideration, it seemed that the critical state of affairs was dependent upon something other than the extraction, and the first blood examination showed an acute myelogenous leucemia to be present.

One might conclude from this case that the dentist should be careful of exerting any trauma in the mouths of persons debilitated by any known general disease, and, furthermore, that if sockets do not heal in reasonable time or if any sign of sloughing occurs, a careful general examination should be made.

The incidence in any one clinic is so rare that but few observations are possible. We have found but four cases in more than 70,000 admissions at Barnes Hospital and eight cases in more than 12,000 admissions at Children's Hospital.

The treatment of the disease is by widespread cautery destruction of the involved area if there is no hope of saving the patient otherwise. X-ray treatment may possibly be of some benefit at times, and the injection of 10 per cent formalin has been done. The mouth should be kept as clean as possible and methylene blue crystals used locally.

ACRODYNIA

Although there is relatively little known about this disease and its care is a general medical problem, there is such striking oral involvement in some cases that it should be described in oral surgical and dental literature.

The following is from an article by Dr. J. B. Bilderback:

In January, 1920, he reported ten cases.

"At that time there was absolutely nothing in the medical literature of the United States on the subject. Weston of Columbia, S. C., reported these cases, calling them acrodynia.

"The term acrodynia (derived from two Greek words, meaning extremity and pain) was first given by Chardon in 1830 to this epidemic disease.

"Acrodynia, or epidemic erythema, is a disease largely affecting adults and is characterized by an erythematous dermatitis especially affecting the palms and soles and followed by pigmentation. It is also followed by vomiting and diarrhea and frequently by cramps and spasms of the muscles, sometimes by paralysis of the legs and general anasarca. It generally runs a course of from two to four weeks, and recurrent attacks are not uncommon.

"The condition we are calling acrodynia in the United States occurs sporadically and only in infants and young children, and differs greatly in its clinical course from the disease described by the French writers. However, the name is being used in recent medical literature and will probably stay.

"It is a disease of the skin and the nervous system involving the vasomotor centers, the motor and the trophic nerves, but affecting particularly the sensory nerves. It is unfortunate that we do not have a suitable name for this striking clinical picture.

"In a well advanced case of acrodynia in a young child, the patient is a pic-

ture of abject misery; no one could look more utterly wretched. While in bed, the patient curls up and burrows his head in the pillow, or sits up with his face held down between his legs. If carried, the child will not hold his head up and begs piteously to be put back in bed. This is particularly so in the cases with photophobia. The child whines almost constantly and dislikes to be disturbed, so that it is very difficult to make an examination. On the face is an expression of abject wretchedness, a picture of extreme mental misery. The eyes are dull and lusterless and denote suffering, reminding one of a wounded animal.

"One of the dramatic occurrences is the loss of teeth; sometimes all that have erupted. Frequently before any pathologic condition of the mouth has been recog-

Fig. 2.—Shows child on the Pediatric Service of Dr. McKim Marriott, St. Louis Children's Hospital, with fairly definite diagnosis of acrodynia. The misery expressed is typical, and all but two teeth have been lost. There is marked pain in the extremities and desquamation of skin, but there is not the excessive perspiration that is usual.

The diagnosis was made with difficulty, because the mother had bathed the child in bichloride of mercury solution for several weeks, and at entry the loss of teeth was such a prominent symptom that the process was thought to be one of salivation.

nized, a perfectly sound tooth will be found in the child's bed. Then it is noticed within a short time that the other teeth are becoming loose in their sockets and finally drop out. The mucous membrane of the mouth seems a little redder than normal, but not spongy and swollen. However, after the teeth are lost an infection may occur in the mouth, with necrosis and shedding of the jaw bone for weeks. At this time the mouth presents an appearance similar to ulcerative stomatitis; the gums are swollen and ulcerated; saliva is profuse, and odor fetid.

"In the later cases, because I have learned to watch the mouth closely, I find that the gums, particularly about the incisors, are a deep, dusky red, even when there is no loss of teeth. The tongue frequently has a raw beef color.

"The most striking symptom is the pink color of the hands and feet. The

erythema is more marked at the ends of the fingers and toes, shading off imperceptibly at the wrist and not extending up the arm.

"The perspiration is marked and occurs over the entire body, saturating the bed clothing. I do not know of any disease in which the perspiration is so excessive and constant. The saliva is increased and will often run from the mouth in a small stream during sleep. The nails in many cases are purplish, and occasionally are lost. Marked anorexia is an almost constant symptom, with consequent loss of weight. Vomiting rarely occurs. The bowel movements are often loose and very foul. Photophobia occurs in many children, often lasting for months. In a well established case, the temperature is normal or, at most, only a degree or so higher unless there are complications, as a pyelitis.

"The etiology of acrodynia is unknown. Evidently it is not a deficiency disease, but the symptoms are suggestive of other deficiency diseases, notably pellagra.

"It is probably an infection, or the aftermath of one. In many cases even with a normal temperature there is a leucocytosis with a relative increase in polymorphonuclears.

"Unfortunately, there is no specific treatment. Until we know more about the etiology, the treatment will remain symptomatic.

"Atropin for the perspiration and calamine lotion for the irritation of the skin constitute the treatment.

"When one observes a child with acrodynia and realizes how little he has to offer, he feels like a therapeutic pauper.

"The diet should be simple, nutritious and rich in vitamins. However, as acrodynia is not a deficiency disease, the kind of food will not shorten the course of the complaint."

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DEPARTMENT OF
DENTISTRY FOR CHILDREN

PREVENT SICKNESS—DEFER OLD AGE

DAVID B. HILL, D.D.S., SALEM, ORE.

HEALTH comes first of all in importance. The race belongs to the strong. Other conditions being equal, those with abounding health are those who prevail. There are only a few examples of men who have performed great service to humanity despite bodily weakness. It is a greater service to prevent ill health than to cure it.

Many of the ills of humanity can be prevented as well as tooth trouble. Many experiments and observations have proved this. The difficult task is to get a health program carried out regularly and early in life, even before the baby is born.

The medical bill of the United States is estimated to be approximately $2,800,000,000.00 annually.

The World War cost this country some twenty billions of dollars; so in seven years we spend as much for medical bills as we spent in the war. For preventive medicine the United States spends only ninety-seven million dollars per year, or only a little over 3 per cent of the total medical bill.

And yet that little 3 per cent has served to abolish practically entirely the serious infectious diseases, has controlled infant mortality, and has raised the expectancy of life from thirty-five years to fifty-five years. If 3 per cent has accomplished these marvels for the benefit of mankind, it is no mere sentiment to say that we ought to give more thought and consideration to the prevention of disease and the conservation of health.

Fully one-third more people reach middle age today than did fifty years ago, but by the time they reach middle age they are in the throes of cancer, heart trouble, diabetes, Bright's disease, and other ailments, all of which have increased most appallingly. The irony of it is that the most of these can be prevented by proper living and attention. Statistics show that 70 per cent of all the human diseases enter through the mouth, and fully 50 per cent of these can be prevented by a clean and healthy mouth.

The most convenient and the best practical information I know on all subjects pertaining to health and the best advice and help in matters pertaining to medicine and dentistry are received from the family doctor and dentist.

Children's teeth in all stages of decay should be repaired or extracted. Do not be told otherwise. To consider children's teeth temporary and to treat them so are equal to considering life itself temporary. All diseases to which the second teeth are subject also affect the first set, and all the serious ways by which the second

teeth may affect the health of the adult, the first teeth may also affect the health of the child. We are only now learning that very many of our diseases are childhood diseases. Tuberculosis, that great white plague, makes its start in childhood. Heart trouble also makes its start in childhood, as well as a number of other ailments. Anything that lowers the vitality increases susceptibility to any of these diseases. Decayed abscessed teeth, discharging pus into the child's system, and irregular and sore teeth which prevent the child from chewing the hard foods that are so necessary to the teeth's and body's welfare certainly lower the vitality.

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

Fig. 1.—First thing in the morning and last thing at night, brush the teeth.
Fig. 2.—Put toothpaste on brush.
Fig. 3.—Brush all four chewing surfaces. Count twenty each surface.
Fig. 4.—Brush two outsides and fronts of upper teeth from the gums down.
Fig. 5.—Brush two outsides and fronts of lower teeth from gums up.

Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10.

Fig. 6.—Brush all back upper teeth on inside from gums down.
Fig. 7.—Brush all back lower teeth on inside from gums up.
Fig. 8.—Brush upper front teeth from inside.
Fig. 9.—Brush lower front teeth from inside.
Fig. 10.—Put toothpaste on flat dental floss and go between the teeth at least once each day.

Decayed teeth of children will do more harm to the health, face and permanent teeth in a few months than the same trouble in adults' teeth will do in years. It is very unfortunate for the children that this is not well known. Parents must appreciate that the same material is used for the child as for the adult, and the work is much harder; so the expense is as great and often greater for children. Young children with decayed teeth should see the dentist every few months because teeth of this structure do not hold fillings well, and if they are kept filled so the child can eat the proper food, they will become stronger.

A beautiful smile costs nothing but gives much. It enriches those who receive, without making poorer those who give. It takes but a moment, but the memory of it sometimes lasts forever. None is so rich or mighty that he can get along

without it, and none is so poor but that he can be made rich by it. A delightful smile creates happiness in the home, fosters good will in business, and is the countersign of friendship. It brings rest to the weary, cheer to the discouraged, sunshine to the sad, and it is nature's antidote for trouble. Yet it cannot be bought, begged, borrowed, or stolen, for it is something that is of no value to any one until it is given away.

It is hard to give a beautiful smile while in ill health or with decayed or uneven teeth. It must radiate wholesomeness.

These pictures and instructions and a three-minute timer will help you and your child to cultivate the wholesome habit of brushing the teeth. Study the pictures of the little girl who made her teeth and face *beautiful. You can, too!*

Always stand before a mirror when brushing the teeth. Use a good toothbrush, a good toothpaste, and rinse the mouth thoroughly with toothpaste suds at finish, forcing it between the teeth.

An efficient system of brushing the teeth so you will clean every part of the teeth and mouth every time you brush them (at least three minutes twice every day) is most important. Dentists know that the stain that gets on the teeth, unless it is removed twice every twenty-four hours, is very hard to remove with a brush. Therefore it is necessary to have a brush and a system that will clean every part of the teeth every time you brush them and to brush at least three minutes twice a day to keep the teeth clean. This is not so hard because there are only four parts of every tooth to brush: top, inside, outside, and in between. Study the pictures. A toothbrush should have a good grade of bristles, set far apart, and should be small enough so it will reach all the back teeth, as these are the hardest to reach and need more brushing. Use the toothpaste you like and will use, but be sure to use one. A toothpaste is to the teeth what soap is to the hands. It helps you do better work. It will not cure decay or diseases of the mouth. This must be done by a dentist.

It is foolishness to say you can put anything into the mouth for four minutes a day that will counteract the action of a number of very active germs the other 1336 minutes of the day. You have a right to expect clean teeth and healthy gums with any good toothpaste, an efficient system of brushing, and a semi-annual visit to your dentist. The gums, all of the tissues of the mouth, and the tongue should be brushed for cleanliness and stimulating effect. Balance the diet by adding plenty of milk and leafy vegetables, and fruit. This is the most sensible method of preventing diseased teeth and gums which often result in ill health.

I have made a study of toothpaste and toothbrushes for years. Very seldom has it been proved that any toothpaste or powder has done harm to the teeth, but the harm done by the lack of enough toothpaste or powder and the proper use of the toothbrush is very noticeable in almost every mouth.

There are many toothbrush sterilizers on the market, but it has been my experience, considering the care necessary to keep them clean and working, that the best results are had by hanging the brush in the air and light.

From the standpoint of good health diet is of primary importance. Mechanical treatment and medicine meet with their fullest measure of success only when due consideration is given to dietary factors. Teeth, bones, and muscles are not fixed, inert supporting tissues, like the structural iron of a skyscraper, but are very live body tissues which can be maintained properly only when the nutritional needs

are adequately met. We should bear in mind that a sick and undernourished child means sick, soft, teeth, muscles and bones. Painful, decayed teeth act as a detriment to eating, and this interferes with the normal intake of food. The child with irregular teeth and dental defects is usually a poor eater.

A balanced diet costs no more and is no harder to prepare than an unbalanced one. It is only a question of knowing. The following simple rules have proved efficient for the average child, and adult also. If you have reason to believe you need a special diet, consult your doctor. Diet fads are dangerous. Do not overeat. Keep the normal weight.

Breakfast: One whole sliced orange; one large glass of milk; poached or boiled egg; cooked cereal with raisins or grape nuts on it if desired, but the egg is more nourishing; whole wheat toast cut thin and toasted hard; fruits—peaches, bananas, pears, apples, figs. The reason for sliced oranges and raisins on the cereal is so the child will have to chew all his food. First, it develops the teeth and bones of the face; and second, it prevents the habit of bolting food and aids digestion.

Lunch.—Vegetable soup, glass of milk, two vegetables to balance diet. The vegetables that grow in the sunshine are best and they are better raw: tomatoes, cabbage, lettuce, celery, carrots, spinach, and beets. Whole wheat bread, egg or meat if desired.

Dinner.—A glass of milk, two cooked vegetables, whole wheat toast. There is no objection to some meat and jelly and desserts if the diet is balanced with two vegetables at lunch and dinner and three large glasses of milk each day, but we all eat too much sweets and meat.

Cod liver oil or Haliver oil should be taken each day, dosage depending on the physical condition of the child, diet, and the climate. A very small amount of candy may be eaten. It should follow meals. Four to six glasses of water each day. Ten to twelve hours sleep for the growing child in a well ventilated room. Breathe deeply through the nose. Keep lips closed tightly. Exercise outside each day. Stand and walk erect.

Orthodontia truly belongs to the field of preventive dentistry and medicine. Children with irregular teeth should receive expert advice and treatment as early as possible. During infancy all parts of the head grow rapidly, and in the case of the normal child, many parts have reached adult dimensions by the time the child is twelve years of age. During this period a proper diet and very little stimulation will accomplish in a short while growth that will require years to accomplish in later life. During this age the retaining period is shortened considerably or avoided altogether.

It is a great handicap to a child to go through life with irregular teeth and a misshaped jaw. A face may be perfect in its type except for some deformity in the lower third, which may exhibit lack of harmonious development which results in irregular teeth. A large majority of our children are hampered in their work and play and in the serious business of adult life by irregular teeth or malformed jaws. There is no need for a child to be handicapped through life with these deformities. Such malformations check normal growth, stunt mental development, sap vigor and disease resistance. All of these conditions can be restored to strength and beauty and normal efficiency. What orthodontia has done for childhood in the correction of facial deformities has produced incalculable happiness and content where

otherwise these children would have dragged through life in mental anguish because of their peculiar facial deformities. The facial harmony and beauty are of as much importance to the patient as are beautiful teeth.

It is not only from the standpoint of good looks that the mouth needs straightening. It helps to secure proper breathing. If the teeth are irregular and protrude so that the mouth does not close properly, the result is mouth-breathing. Most of

Fig. 11.

Fig. 12.

the nasal and sinus trouble in later life is caused from this, and a mouth-breather contracts colds and other diseases very readily.

Coarse hard foods which are so necessary to the body's and teeth's welfare are avoided altogether or swallowed whole. Irregular teeth also are hard to keep clean and are one of the chief causes of pyorrhea and decay and if not corrected are a source of trouble and expense all through life.

Very often it is difficult to state the exact cause of any dentofacial deformity. What we sometimes cite as local causes are primarily caused by abnormal physical

conditions. Faulty diet and nutrition are important factors. This has been very effectively demonstrated in the past few years.

The following diseases effect the development of the teeth and jaws: tuberculosis, measles, scarlet fever, chickenpox, rickets, and in fact, all diseases accompanied by high temperature early in childhood. Local causes are: enlarged tonsils and adenoids, decayed deciduous teeth which prevent hard use of the teeth, thus causing failure of normal enlargement of the arch, too early loss or long retention of the deciduous teeth, thumb sucking, lip and tongue habits, lip biting, and the use of pacifiers. These are the most common causes.

In conclusion let me state frankly that it is comparatively easy to collect material from many sources and write upon any subject. You can rely upon this brief information given here because it has been collected from the leading schools. hospitals, and men in medicine and dentistry.

CHILDREN'S PREVENTIVE DENTISTRY—THE SCHOOL DENTAL CLINIC*

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IT IS not my purpose to delve into a scientific technical discussion as to the methods used in children's operative dentistry. That would require one with far more experience than I have had. Even then, I doubt the good that would be derived from such a discussion; for, after all, the method that is best suited to the needs of the individual operator is the procedure he should follow; that is, understanding that the operator is a well informed practitioner, who keeps abreast of the times, and is sincere and conscientious in his work. Different methods and technic are only different paths leading to the same goal, and one must walk the path which is best adapted to one's own peculiar needs.

I wish to speak on the importance of preventive dentistry, and I firmly believe that with the child, the school child, the most effective work can be done. Dr. Charles H. Mayo of Rochester, Minn., has said that "80 per cent of all children's diseases arise in the mouth, nose, or throat; and that 90 per cent of all deaths occur as a result of diseases that arise in this area, or of the development in other parts of the body of diseases that have their origin in the nasal or oral cavity." With children, then, there lie glorious possibilities for us as a profession with an obligation to the people.

The adults of this generation, your patients, are suffering from dental disorders, systemic disturbances of all forms and descriptions, and we know that a large percentage of these systemic disorders can be traced directly to the mouth. All of you are convinced of that fact, and are working earnestly to remove the mouth infection in these cases preliminary to clearing up degenerative diseases of the heart, kidneys and other organs of the body. You make your beautiful restorations, your highly polished inlays, your correctly contoured crowns and bridges. You treat the different periodontal diseases with great skill and exacting technic. It is all too wonderful the way you skilled dental surgeons of today are reproducing nature and restoring that which she has destroyed. You are truly masters of your science.

However, our profession is responsible for something more than restorative work, and while we cannot slight this all important field, we must as professional men go deeper and more whole-heartedly into preventive dentistry. I realize there are many problems in regard to preventive dentistry yet unsolved, but, nevertheless, there are many practical things that come under the head of prevention which we can all do. We must teach and protect our patients so that they may not continue to suffer from the inroads of dental diseases; teach them the *true* principles of mouth health. Are we going to sit idly by and let the coming generation suffer from dental disorders as this generation is suffering, when it is in our power to prevent a large percentage of the troubles that await the children

*Read before the Florida State Dental Society, Hollywood, Florida, November 3, 1932.

of today? Surely the place to practice preventive dentistry is on the child. Do not wait until his dental organ is wrecked before you tell him how to care for his mouth. Do not wait until he is dying of a nephritic infection or a cardiac lesion before you teach him to brush his teeth. He realizes all this after it is too late. When his teeth are aching and loose, he knows that they should have been cared for years before. What we must do as dentists is to educate and enlighten the public before these terrible maladies exist. Firm, healthy teeth, and healthy tissue surrounding the teeth, denote high resistance to disease, and will tend to reduce the number of carriers of disease. Oral prophylaxis is a great preventive measure against disease. Sir John Osler, the famous English physician, once said, "There is not one single thing in preventive medicine that equals oral hygiene and the preservation of the teeth." Putting the mouth in a healthy condition should be the first step taken to prevent the so-called childhood diseases, and if this oral health is continued throughout life, it will reduce in the same proportion the degenerative diseases of old age. We must preach preventive dentistry; we must serve our patients to the best of our ability. It is said that "to cure is the voice of the past, to prevent is the divine whisper of the future."

Are you practicing dentistry as it was practiced twenty years ago; that is, just filling, pulling and occasionally cleaning teeth? Or are you teaching folks to care for their teeth and to prevent future ills? To how many patients do you give instructions as to proper home care of the mouth, to massage and stimulate the gums properly, and to be able to detect the beginning of decay and periodontoclasia? Are you teaching your patients to select and masticate properly their food on both sides of their mouths, to use daily a balanced diet which will supply the needed elements to build bones, teeth and good tissues? Do you tell the mother about the care that must be exercised during the prenatal and nursing periods, that what she consumes in her diet during these periods has a great deal to do with her child's first teeth? Do you tell her the story of how teeth are formed and how they grow, about deciduous teeth, the six-year molar, the twelve-year molar, the function of the cusp and shape of the teeth, the harms of malocclusion and tartar? Tell the mothers that twenty-eight good, clean, healthy, natural teeth, and good sound gums are the foundation of a healthy body, and that good health is a great life asset; sickness is a liability more burdensome than a heavy debt. It is not enough to correct and repair; we must teach, for we are the guardians of the nation's health.

I am here in the interest of the boys and girls back in your community who are being retarded in their physical and mental development because of defective and aching teeth, and there are an infinite number of such cases in Florida. I daresay 80 per cent of our school children are in need of dental attention, and half of this 80 per cent are actually suffering. Many of their parents cannot have the necessary work done. There was a time when the father could take the child down to the advertiser on the corner, and for perhaps fifty cents have the offending member yanked out; but they do not have the fifty cents now. Thousands of them barely have enough to buy bread.

It is not up to you gentlemen in private practice to bear the burden of these cases, but they must be cared for in some way. It is not fair for children to be handicapped during the important formative years of their lives when they need every ounce of energy in preparing themselves for the tasks of tomorrow. The

state of Florida is spending thousands of dollars for vaccines, antitoxins, and other health measures, which is all very fine, but how much are they spending to fight the most prevalent of all diseases—dental caries, which is undermining the health of thousands of children in this state. It is time something was done about it.

Through the north and east, school dental clinics are fast becoming a part of the public school system. They are fast proving themselves to be the most effective way to carry out a mouth health program, and also the means by which decay is kept to a minimum, thereby insuring children against the awful dental conditions of the adults of this generation. If you will pardon any personal reference, I should like to tell you briefly of the clinic with which I am connected, and the success with which we have met in Pinellas County. Various methods have been tried and clinics started in our county to care for the indigent children and try to relieve the terrible dental condition among our poor. Clinics were formed whereby people paid whatever amount they could afford, perhaps twenty-five cents or perhaps fifty cents. Another method was tried where the patients paid a small fee for each operation, or if they happened to be in destitute circumstances, treatment was done free. The local dentists donated their services for a few hours each week. At one time, there was a part time operator employed, but none of these plans were successful, and very little real good was derived from such an arrangement.

In the summer of 1929, the St. Petersburg Dental Society, realizing the need of a clinic in the community, and also the importance of dental education, and knowing from past failures that care must be taken in the establishment of a clinic, decided, after careful study, that the most effective work could be done only on the child. Realizing that the school and the child go hand in hand, and that the child learns his A, B, C's, his reading and his arithmetic in school, why should he not learn to care for his mouth at the same place he learns the other requirements needed to develop into a high class citizen, for truly without health his school training is worth little. After convincing themselves upon this point, a committee was appointed to be known as the clinic committee. It was their duty to go before the school board and, so to speak, to sell them on the idea, and to get this board to appropriate money for the maintenance of this clinic. This was done, and shortly afterward we opened our school clinic for the purpose of teaching mouth health to the school children of Pinellas County, also to correct the defects that exist in the mouths of the indigent children through the sixth grade. Realizing that "knowledge without health cannot profit one," we are waging an intensive and active campaign to eliminate dental defects, to prevent infectious diseases, to decrease absences from school and failure in grades, and to prevent the children from being unnecessarily retarded and impaired in future life.

This clinic is under the supervision of the St. Petersburg Dental Society, and let me say at this point that all dental clinics should be directly under the control and supervision of the local or state society if they are to be operated successfully and able to render the service expected of them. The moment they get from under the authority of ethical men, they are doomed to failure, and dentistry will suffer from the effects. There should be a dentist on every state board of health to insure dentistry of its rightful place in public health work. Every city health council should have a dentist to supervise the dental health work of that community. I do not believe in a free school clinic for children above the eighth grade. The reason

I have for this assertion is that when they reach the eighth grade, they are fourteen to fifteen years of age, and they should be taught to help themselves and not led to believe that dentistry is handed out free to every one. It must be firmly impressed upon their minds that an effort must be made on their part to secure dental services.

We have three school nurses whose duty it is to investigate each case, and to give the clinic a written report as to the financial condition of the family before they are admitted. We also require the parents to sign a card that they wish all dental defects corrected. The nurses transport the children to and from the clinic. This insures punctuality on the part of the children, thereby eliminating any loss of time between patients.

We keep a complete case history for each patient, consisting of name, address, place of birth, date of birth, parents' financial condition in detail, history of diseases, grade, teacher, scholastic record, height and weight, and answers to the following questions: ever been to a dentist before; do you own a toothbrush. (It is surprising the number that do not have a toothbrush, about one-half I should say.) Our record cards are made to cover a period of six years, or all of the elementary grades. A complete record of all corrective work done and any abnormalities that may exist is kept. There is also a place on this card for "record after correction." Three months after the child has been dismissed from the clinic, we interview his teacher to find whether there has been any improvement noticed in general health, scholastic standing, attitude toward work, or if the attendance is better. The reports these teachers give are startling. Almost every child who has had corrective work done shows immediate improvement in his school activities.

It has been my privilege to serve more than thirteen hundred children during the time that I have been connected with the Pinellas County schools. Each child's mouth has been carefully studied and put in a healthy condition. Over seven thousand mouth corrections have been made on these thirteen hundred children. Some very interesting material has been gathered from these little patients of mine who have come from families throughout our county, and I believe they are representative of a cross-section of the populace of any section of our state. Therefore, what I have gathered from my case histories on these little tots, I believe, will interest every man here, and make him realize more forcibly dentistry's obligation to the children of this state, and his obligation to the children of his community, also the wonderful service that we as dentists can render to our fellow man through the little child, who is far more cooperative, willing and interested than are our adult patients.

First, let me say that in handling and serving these children, I have found that you must love each and every one of them, and believe in the work and the results that you are attempting. I believe in little children, and I am serving and caring for them to the best of my ability. Treat them as individuals. I interest myself in each of their little hobbies, be it a kite or little baby sister. I let them know that I am interested in everything that they are interested in. I love to have, and try to encourage them, to drop in to see me every time that they can, not just when there is dental work to be done. They come in to show me how fine they are caring for their mouths, not teeth. Never tell them just to brush their teeth, there is much more to it than that. The gums must be brushed and massaged, the tongue must be cleaned. I try to get away from teeth as far as possible. It is the mouth as a whole

that I wish for them to keep clean and healthy. At this point let me add that to get children to care for their mouths properly, you must personally show them how it is done. I clean my mouth in the presence of each child, go through every detail and explain as I progress just why I do it in this manner and not in some other way. I use the illustration about the cracks in the floor, saying "your mother does not sweep all the dirt on the floor into the cracks, does she? When you brush your teeth crossways, you are doing that very thing. Now the thing we want to do is to sweep that old food out, and to do that you must sweep down on the upper teeth and up on the lower ones." After demonstrating in my mouth, I present the child with a new toothbrush, donated by the County Tuberculosis and Health Association, and have him go through the whole procedure before me. This takes lots of time, but it is well worth while, and the only method I have found successful to fix firmly in the child's mind exactly the procedure he should follow. I try to follow this up by requesting the teachers to make it a part of their routine to ask the class each morning if they cleaned their mouths last night before going to bed and this morning before coming to school. If there are any who have not, they must go and clean their mouths with cotton and soda before beginning the day's work. I doubt the good that cleaning with cotton does, but the point is to impress upon the child that his mouth must be clean. It is remarkable the success and influence a teacher can have over children. She can prevail upon them when parents fail. Our success depends largely on our school teachers, and I find them to be a wonderful group, always willing and eager to cooperate in every way possible to boost mouth health. They are sold on the idea. All we must do is to tell them their part of the program.

Another point, try to encourage the child to be brave, to come into your operating room without the parent. I never allow a parent in my operating room, for reasons quite obvious to each of you. Parents usually threaten or frighten the child, and are often more upset than is the little patient. The child must learn to depend upon himself, and we should teach parents that the best parenthood is to teach children to depend upon themselves rather than upon mother. Do not talk baby talk to your child patient. Treat him as you would an adult patient. If it becomes necessary to hurt him a little, tell him so and explain why. Talk to him about his mouth, and explain its relationship to the rest of the body. I give every patient a new toothbrush, as I have already stated, but I do not give them any toothpaste. I believe that it conveys the wrong impression. All of my patients are extremely poor, many too poor to purchase a dentifrice. You give them dental cream, and right away they get the idea that they must have it in order to cleanse their mouths. I tell them to use baking soda, the same kind that mother uses in her biscuits. Try to impress that it is the elbow grease behind the brush, and not the material on the brush that does the work.

I have stated that we have met with wonderful success, more than we contemplated. Teachers reported numbers of cases where the children showed definite improvement in their scholastic work after the dental defects were corrected. Attendance records were better than ever before, and for this reason Pinellas County will get ten thousand dollars more from the state this year than last, state appropriations being based on average attendance in the schools.

I know not how to express the good that has been accomplished in our county as a result of this mouth health program. It has paid for itself in dollars and cents.

In fact, it has earned money for the school system, but aside from that it has reduced communicable diseases and all sickness among our children. It has afforded each child a medium whereby he may have a clean healthy mouth and thus be that much further along the road to good health. It has put beautiful smiles upon the faces of many, whose smiles were once only a display of filthy, badly stained teeth. What is finer than a happy smile from a healthy child? It is the greatest thing in the world, and it is our privilege to be partly responsible for it.

This has been a rather rambling and disconnected paper, but I have tried to bring before you a few thoughts and ideas on this most vital subject, and also to give you an insight into the success we have met with in Pinellas County, due largely to a group of conscientious, wide-awake dentists who have put their shoulders to the wheel and have given of their time and skill in an unselfish manner for the advancement of this work. Without the aid and support of our ethical men, there will be no progress made in dental education. I have brought these thoughts and suggestions in the hope of stimulating and awakening new interest in this preventive work, hoping that you will return to your community, be it large or small, and get some programs started that will benefit children, thereby benefiting all, parents, town, state, and nation. For it is said that "A nation is no stronger than its weakest child." Lastly you will benefit yourself and your profession, for you will have served, and served well, those who are helpless to help themselves.

THE BUSINESS ASPECT OF CHILDREN'S DENTISTRY*

WALTER C. MCBRIDE, D.D.S., DETROIT, MICH.

WHEN a dentist refuses to work for children or fails to render them satisfactory service, he literally throws over his shoulder one of the finest factors in practice-building he could possibly hope to utilize.

Fortunately, some men can afford to do this and still have a practice that is constantly replenished by the references of their age-increasing and death-diminishing original patients. Practices, through the years, seem to keep pace with the increasing years of the operators. Patients of men who have practiced twenty-five to thirty years are to a great extent, older patients. A friend, popular among

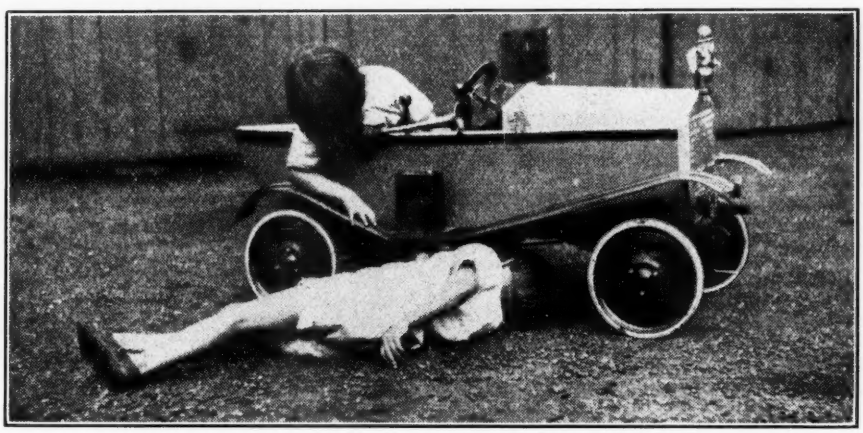


Fig. 1.—The natural curiosity of children can be turned to good advantage when they come to you for treatment.

his associates in high school and college, who attracted to himself in the early years of his practice people of his own age, with simple restorative needs, and who has now practiced thirteen years, says that in the last few years his work has grown to be a partial denture and bridge service mainly. Another acquaintance with thirty years of service to his credit says that 75 per cent of his practice is denture construction, a great deal of which is for patients who cast in their dental lot with him when he first set up in practice.

A dentist just out of college opened an office in a town of some 2,000 inhabitants where two dentists had successfully plied their craft over a period of years. They were not particularly receptive to the newcomer who might conscript a pittance from their income, and who had the audacity, as a beginner, to install beautiful new equipment and employ an office assistant as well. Two things—(1) that his income was somewhat discouraging and (2) that he especially enjoyed children, led him to suggest to the older men that, inasmuch as they did not enjoy

*Reprinted from The Dental Magazine and Oral Topics, November and December, 1932.

children's work, which he did, he would be glad to have the children referred to him. The idea met with immediate approval and the children came. They liked the new dentist, apparently because he knew something of the functioning of the child's mind and acted accordingly. A favorable report was carried home to the parents. Soon the mothers came for an appointment, feeling, with reason, that any one who can work for children and make them like it must have a benevolent regard for an aching and sore tooth, and use, as well, a great deal of dexterity in caring for one. Finally came the fathers. In three years' time two new equipments and two additional dental assistants came to town as an inducement for the return of the forfeited patients. It was not equipment and assistants that were needed but a favorable attitude and regard for the young patient.

Under the heading of "The Business Aspect of Children's Dentistry" must of necessity come the discussion of fees. The question of fees is an old unsolved story, with many interesting and perplexing ramifications. In this article I

Fig. 2.—The boys—what will they become?

should like to dress it up in a new gown, if I may, and attempt to make it appear more attractive.

BASIS FOR FEES

Some operators, in exclusive pedodontic practices, employ the yearly contract arrangement, i. e., a fee-per-year basis for each patient paid at periodic intervals throughout the year, the same to include every necessary service as well as a monthly examination and prophylaxis. This idea is not new, it having been used with success by a number of operators over a period of years. It is advantageous in that the cost is definite and uniform. It is disadvantageous, primarily, because it is difficult to maintain over a period of years a monthly schedule of visits, and, secondly, because human nature, under such a procedure, presents a procrastinating tendency on the operator's part towards incipient needs of the patient.

Children's dental work almost of necessity, I believe, must be handled on an hourly basis. Just so long as children's work is cared for on a fee-per-operation

plan, just so long will the average operator feel a decided lack of interest in working for children. In this plan all work is done at an hourly rate, with the exception of prophylaxes and extractions, which cost is more or less uniform.

A fee-per-hour basis will maintain the morale and composure of the operator when working for an obstreperous child who demands more than the expected time.

It will also equalize the cost of fillings. Many times little is done of an operative nature at the initial appointment; yet a great deal is accomplished by way of instruction to the young patient and the building up of confidence and friendship. A small occlusal pit filling or a sedative treatment at the first appointment hour may bear the same fee as the filling of two or three teeth at the second appointment. When the mouth is completed, the total fee spread over the completed work satisfactorily equalizes the filling costs so far as the parent is concerned.

GIVE AN ESTIMATE

With new patients of apparently ordinary means, and especially if an unusual amount of work is required, an estimate should be given. I remark to the parents of such children, after I have examined the child, "Would you like to know something of the cost of the work?" Receiving the affirmative reply, I continue, "If we extract these teeth the charge for the work will be—; if we treat and maintain them it will be —." This gives the parent an option which might of necessity be governed by the family exchequer; however, I advise and stress the importance of maintenance or extraction as the case may be. Many times the character of the work must be controlled by the family pocketbook. Again, possibly the importance I may place on some restorative need may induce the parent to have the work done at the expense of some other minor desire or luxury. When a request comes by telephone for an estimate I always say, "I can give you an estimate at the time of the examination, or a definite stipulation at the end of the first appointment." To patients coming in for examination I remark, "The charges for the work will be approximately —; if you would like a definite stipulation I will give it to you at the end of the first appointment hour." Under this arrangement I can ascertain the child's response and how rapidly I can proceed with the work. It permits, as well, a more thorough examination of questionable teeth.

HOW TO REPLY TO CROSS-QUESTIONS

When an estimate is given the parent will invariably ask, as he or she mentally tries to reckon the scale of cost per operation, "How much do you charge per filling?" To this request I have worn threadbare the following reply, "I have no charge per filling. Many times I will put in three or four fillings for three or four dollars, and many times charge that much for one. The cost is dependent upon the size of the cavity and the response of the child." Invariably, the next inquiry is, "Do you charge by the hour?" If you admit that you do, you will again be confronted with another embarrassing situation, for the inquiry will come, "How much do you charge per hour?" When asked if I charge by the hour I usually reply, "Yes and no. I look over the mouth and decide in my own way about how many appointments will be required and the length of the different

appointments.'' If it can be avoided, one should not admit an hourly charge, even though it be the only satisfactory way to care for children.

The assertion that ''the cost will be dependent upon the size of the cavity and the response of the child'' makes parents solicitous of two things: (1) the detection and filling of small cavities, and (2) the good behavior of the child. They appreciate that if the child comes regularly the fillings will be smaller and will, therefore, cost less, and also that if the child's behavior is better the cost will be less. Any reasonable procedure which ultimately extracts less from the family purse has a very strong appeal.

Arrangements for payment can easily be made at the time the estimate is given. There are however, many middle-class people who are too proud to ask for an estimate. Many times these parents wish to pay at each appointment. Of all the abominable plans of payment, psychologically at least, the pay-as-you-go plan heads the list. When a mother remarks at the end of the appointment hour, ''How much will that be today?'' I always reply, ''I'll tell you how much the total bill will be and you can leave what you like.''

For example, I may know that Mary Smith's work will cost about $22.00, but no estimate was asked or given. If, at the end of the first appointment, the mother inquires, ''How much will that be today?'' and I reply, ''$5.00,'' she instinctively thinks I am high-priced because apparently so little was done. At the second appointment I may ask for $7.00. She may not think that too much for the amount of work done (at the second appointment one can accomplish a great deal more because the child is already familiar with procedures, and one can proceed in earnest), but she has not $7.00 with her, and, coupled with her embarrassment is the thought again that I am high-priced. And so on through the four or five appointments necessary to complete the work. On the other hand, I can tell her what the total will be and let her leave as much each time as desired, or tell her what the total will be at the completion of the work, or send a statement at the end of the month and the money will be paid without a sign of protest. If they do think I am high-priced, it will be only once, so to speak, which is a distinct advantage over the other plan psychologically.

As an illustration, suppose that en route to the office this morning your car failed to function and, to correct the trouble, the mechanic exacted $4.50 from you. If you happened to have $10.00 on you the $4.50 did not affect you too greatly because you still had $5.50 to carry you through the day. But if, on another day, when you have but $5.00 with you, the same thing occurs and the garage man asks you $4.50 you instinctively think him a ''robber.'' Human nature—you and I are alike. This thought, coupled with the fact that people carry very little money with them these days, is my reason for suggesting that the pay-as-you-go plan is psychologically all wrong.

UTILIZING THE AFTER-SCHOOL HOURS

It is common knowledge that the after-school hours, 4 to 6 P.M., are the lull hours in the average practice. It is too late for the mother who must prepare dinner, and too early for the father who must come after business hours. This makes an excellent place to work in your child patients. For example, let us

utilize this two-hour period for four half-hour appointments daily for children for one week and see what are the results attained.

To do so one must first decide how much he should earn per hour to offset his overhead and gain an average net return.

One may select four or six, or eight or ten or more dollars per hour as one chooses, but, on the average, perhaps $6.00 would approximate the average for the majority; so, for this example, we shall use that figure. If you feel it is not enough, you may add accordingly to the total; if too much, you may subtract. To begin, we shall assume that the four o'clock patient on Monday afternoon requires a prophylaxis and one small pit filling. This can be done in thirty minutes with a resultant fee of $3.00.

The next patient at 4:30 requires a number of restorations, but today, contrary to the usual custom of attempting to fill six or eight badly broken down teeth at one appointment, thereby completing the patient at one appointment but entailing subsequent trouble and do-over work, you elect to do two proximal fillings only. The cavities can be prepared with step preparations, isolated and sterilized, a cavity liner applied, a matrix used and the alloy filling well mixed, packed and carved in thirty minutes if you work diligently. Fee, $3.00—a very fair fee.

The third patient requires a number of small occlusal fillings. On the basis as suggested above, possibly one could do three, four, or five small occlusal filling in thirty minutes. Charge, $3.00—an unusually low fee, but it carries the point you have in mind—that greater frequency of visits will reduce the cost of service because of the time requirement incident to small fillings. Consider this occasion an opportunity to thoroughly sell your idea of appointment frequency. If, in this instance, the operator feels the fee is too low for so great an apparent service and increases it, he immediately defeats the purpose.

The 5:30 o'clock patient, again, may need a prophylaxis and the removal of an exfoliating tooth. Fee, $3.00. This makes a total of $12.00 for the two-hour period, $60.00 for the week, and $240.00 for the month, as follows:

4 P.M.	Prophylaxis; 1 occlusal filling	$3.00
4:30 P.M.	2 Proximal fillings	3.00
5 P.M.	4 Small occlusal fillings	3.00
5:30 P.M.	Prophylaxis; extraction	3.00
		$12.00
	For week	$60.00
	For month	$240.00

Now, as you look at this chart, you perhaps assume or admit that my addition and multiplication are right and that it looks fine on paper, but it is not practical. It *is* practical. For ten years I have earned my livelihood strictly on this fee-per-hour basis, a condition which you will find true in nearly every office where children play an important part. Further, should the operator earn $240.00 in denture or bridge construction, the laboratory and material cost would be possibly $40.00 to $60.00. In $240.00 earned in children's work, I am sure the material cost would not exceed $12.00. The proportionate net is much greater in a children's practice.

Sweet, of Oakland, California, cared for 110 institutionalized children over a six and one-half year period at a fee of $7.00 per hour and learned that the cost of dental services for these children was $11.40 per year. At the recent American Dental Association meeting, in a verbal report, he confirmed these figures by stating that he had, in the last few years, increased this number to 2,000 children and found that the average of $11.40 was constant. This average fee included three examinations and prophylaxes per year—at four-month intervals—and all the other necessary dental services.

He uses this fact in his own private practice, stating to parents that the average cost of dental services for children is $12.00 per year, or for the length of time that children remain with the pedodontist—approximately ten years—the cost is approximately $120.00.

Personally, I think this is an excellent thought to present to parents who come seeking an estimate on their children's immediate needs. The initial costs are always greater, as his records showed, but the follow-up work per year was sufficiently reduced to bring the average fee down to the amount specified.

Sweet's Records: 110 children. Six and one-half year period. $7.00 per hour.

Initial appointments ($2.34 to $18.32) average $12.44.

Follow-up per year ($7.09 to $10.27) average $9.38.

Combined (initial and follow-up) ($7.41 to $13.11) average $11.40.

"JUST SMALL THINGS"

Back in the golden days of 1929, when conditions were such that a very little variation in the income brought a storm of protest and concern, I heard repeatedly from dentists these familiar words, as business conditions were inquired after, "Keeping busy all right, but just small things—prophylaxes and amalgam fillings; no big stuff." Always, being a pedodontist, this gullible and lack-of-business-sense attitude irritated me and made me feel at times as though I should like to go out and acquire a monkey and a fiddle and attempt to replenish both productively and financially a practice that was made up entirely of "just small things—prophylaxes and amalgam fillings; no big stuff."

Prompted by this thought, I made up a chart and used it throughout 1931, to ascertain what phase of my work was most productive. It is as follows:

	PER CENT
Prophylaxes	23.0
Fillings	47.0
Gold Inlays	2.5
Extractions, local	2.4
Extractions, general	10.1
X-ray pictures	2.1
Treatments	5.3
Miscellaneous	6.0
Broken or cancelled appointments	1.6

To me, the most amazing and gratifying thing shown here is that I derived approximately one-fourth of my income from the simple, ordinary and plebeian task—prophylaxis. I appreciated fully, also, the value of a general anesthetic in a practice devoted to children.

ORGANIZING A SUCCESSFUL PRACTICE

The few suggestions made here are not entirely new, in fact some are very old, but I list them purely to remind you of their usefulness and effectiveness.

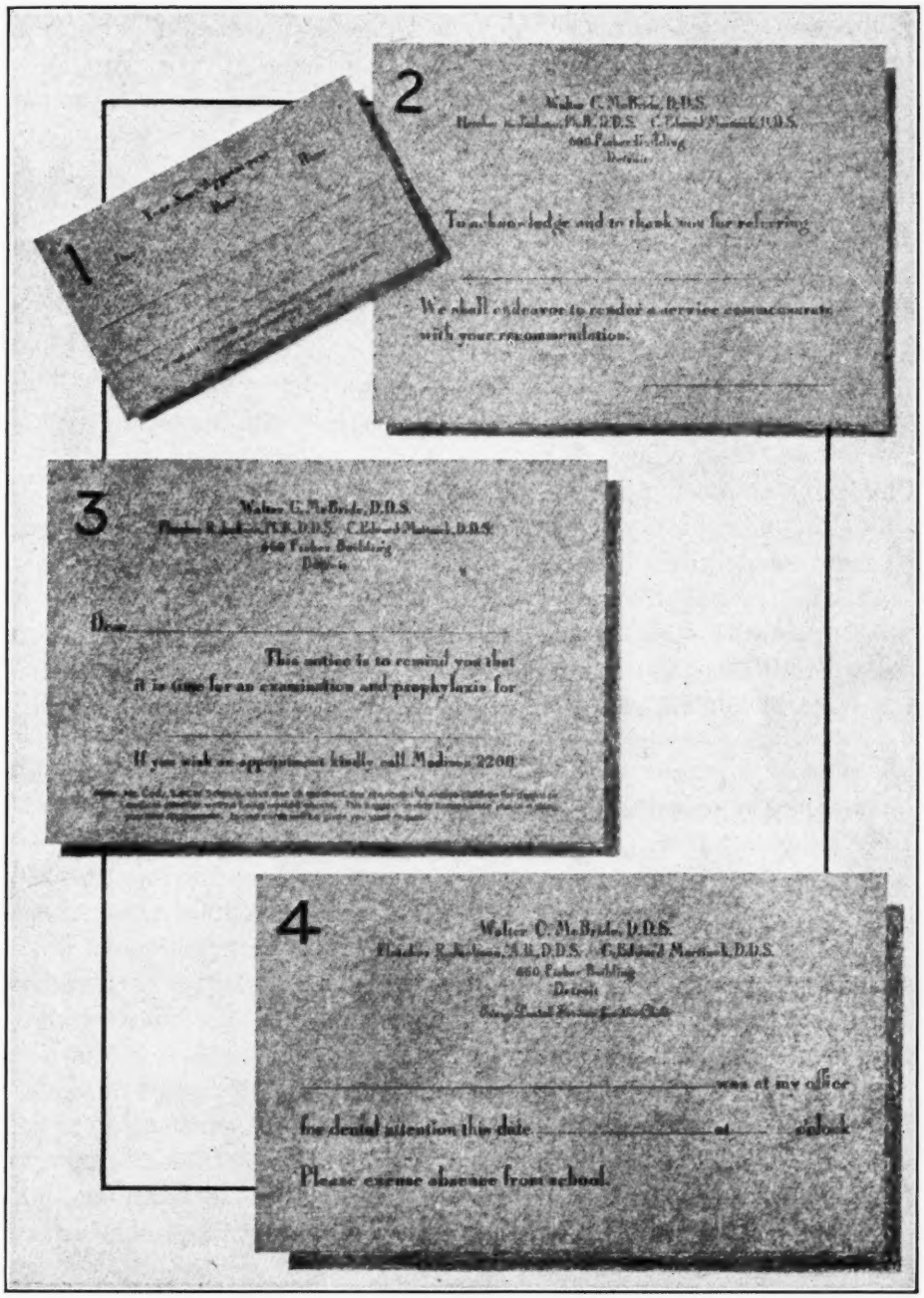

1
2
We shall endeavor to render a service commensurate with your recommendation.
3
This notice is to remind you that
it is time for an examination and prophylaxis for
If you wish an appointment kindly call Madison 2200
4
was at my office
for dental attention this date
at
o'clock
Please excuse absence from school.

Fig. 3.—1. Appointment card. Make use of the reverse side of your professional card for this. 2. Acknowledgment card. A courtesy which referring doctors and recommending patients will appreciate. 3. Prophylaxis reminder card. 4. Excuse card. Filled in and given to the child who is seen during school hours to hand to the teacher.

Many times, out of three or four possible appointment dates given, the patient will select one and then, not having made a note of it will arrive at the wrong hour, and, many times, on the wrong day. Utilizing the reverse side of one's busi-

ness card as an appointment card, at very little additional cost, will almost entirely eliminate this confusion.

I have always acknowledged the reference of a patient either by telephone or card, but preferably with a card as shown in Fig. 3. Referring dentists appreciate that acknowledgments of this type are merely matters of form, but still they are pleased to be informed that Mrs. Brown, whom they directed to a certain office, has presented herself for treatment. It is no more than ordinary courtesy to inform and be informed.

While only a courteous formality in regard to a referring dentist or physician, this card has an added psychologic value when received by a referring layman. Men in general practice could effectively utilize this acknowledgment courtesy inasmuch as all their references come entirely from lay people.

In my practice the Prophylaxis Reminder Card is sent to all children at four-month intervals until the permanent teeth are erupted (approximately twelve years), at which time a twice-yearly notice is sent. The remark from our superintendent of schools, as listed thereon, has proved very satisfactory in getting children excused from school.

Children who have appointments during school hours are given an Excuse Card, filled in and signed, which is taken back to the teacher. This information, coming from the dentist, satisfies the teacher that the child has actually been to the dental office, instead of having been somewhere else under the guise of a dental or medical appointment so common to absences from school, and makes the teacher willing to permit absences for further treatment. Also, it brings one's name before the educational staff, which is not without its advantages.

A PATIENT'S "WHO'S WHO"

For the psychologic appeal it makes, I keep an alphabetical list of the names of all my patients. Usually when the mother calls for an appointment she remarks, "I am Mrs. Abbot. I would like to make an appointment for the children." Immediately, the assistant turns to the name given and, discovering what the children's names are, remarks, "You would like an appointment for Robert and Anne." One can almost feel the pride in the mother's voice at finding that the children's names have, apparently, been remembered.

I am firmly convinced that in every dental appointment there is something of a professional, of a business, and of a social nature. Accordingly, on my record cards, I make notes under these three headings and I can assure you that at the subsequent appointments I find the information listed of considerable importance.

From a purely professional viewpoint, so that I may be familiar and conversant with conditions at all times, I make full notations. The following is from cards taken at random from the file:

Mentioned need for orthodontia. Referred to ————.
Suggested need for spacer. Parent uninterested.
Advised excision of frenum at seven and one-half years as laterals erupt.
Two exfoliating teeth with cavities. Will extract if trouble.
Molar grooves deep. Parent advised.
Asked concerning orthodontia. Advised waiting one year.
Advised extraction. Parent wished retained if possible.

Notations of a business nature I list in case there is any question regarding the amount or payment of the account. For instance:

Appt. cancelled at appt. time. Child did not want to come. $—.
Cancelled 8:30 A.M. Child has measles. (No charge.)
Cancelled appt. Accident. (No charge.)
Cancelled appt. at appt. hour. School examination. (Next appt.: Child said no examination; went to show.) $—.
Broken appt. Called after appt. hour. $—.

Notations of a social nature are made for the human interest it reveals. It creates a pleasant atmosphere to ask at some future time about the new baby, or the new home recently built, or the father's new business venture, or the camp John went to for the summer, etc. Notations under this head on other cards from the file read as follows:

Going to grandfather's farm for summer.
New baby brother—John Francis.
Moved into new home.
Brother Bill broke hip—in cast at Harper Hospital.

ADVANTAGES OF WORKING FOR CHILDREN

There are two features of children's dentistry, which have been totally unexpected and overlooked, and which have proved very encouraging to those engaged in it, i. e., the constancy of the work and the constancy of the collections. It is human nature to supply the child's needs first. If your finances are low and both you and your child need dental attention, there is no question whatever who receives the first care. This fact can be verified by the constancy of the work in pedodontic offices, even during these days of depression, and in offices where children make up a large portion of the practice.

The constancy of collection can be attributed to the fact that charges for children's dental services are never big at any one given time. Sweet has suggested the range of charges at different periods. The average amount of the statements leaving my office monthly—that is, the total amount of the statements divided by the number of children to whom they refer—varies between $8.00 and $11.00. These, as accounts go, are small. When the recipient becomes panic-stricken about the ninth or tenth of the month because there is not sufficient cash at the bank to meet his entire indebtedness, he sorts out the small bills into one pile, the larger ones into another, and pays the small ones first. The account for the child's services falls into the first group and the check comes in. Should there be any money left over, the dentist attending the parent may or may not receive a $5.00 installment on the $150.00 denture or removable bridge.

The story is told of a man who especially enjoyed fruit for the final course of his meal, and who always put on magnifying glasses when sitting down to dine because it made the apples and grapes, his favorites, appear more tempting and appetizing than the other foods. Similarly, the dentist is wearing magnifying glasses who avoids dental service for the child, seeking and seeing only the wide open spaces where bridges and dentures, his favorites, may be inserted.

Both are optical illusions—the first is an insult to an expectant stomach, the second is a gamble whereby a probable constant average remuneration is forfeited for the possible isolated big fee operation.

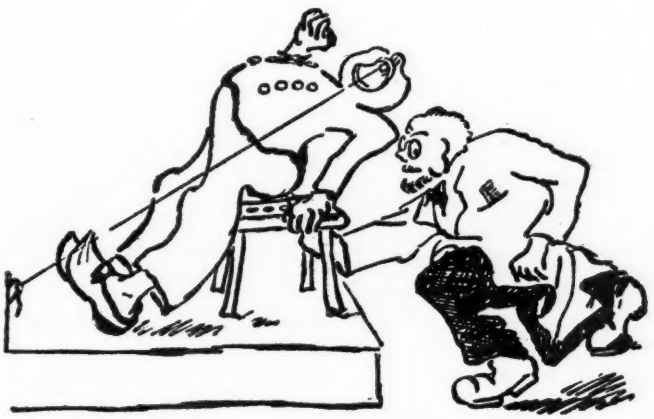
If one can view pedodontia from the standpoint of a constant average remuneration, on a fee-per-hour basis, one will see much of merit in its practice.

THE PSYCHOLOGY OF THE CHILD AND HOW IT CAN BE TURNED TO ADVANTAGE IN DENTISTRY*

DR. ED. SCHRICKEL, BOCHUM, GERMANY
Director of the Children's Dental Clinic

TIMES have changed since those early days when the susceptibility and oversensitiveness of the modern temperament were unknown, and when patients apparently possessed the iron nerves required to enable them to bear dental treatment as then practiced.

Today, technic strides from success to success, drawing from nature one secret after another; manual skill is ever being developed and methods of treatment are being improved, but knowledge of the science of psychology has not gone



Teeth can be drawn with a pin or a string,
With a knock on the head or some other such thing;
Today it's quite different, we plainly can see,
For dentistry's painless as painless could be.

ahead at the same rate, although the increased sensibility of the patient has kept pace with the increased technical skill of the practitioner.

That the child of today is more highly strung and sensitive than his forbears is now realized, and the fact has been brought home by the establishment of dental school clinics, so that since the war special attention has been given to the psychology of the child patient.

The first necessity for the successful solving of the problem of the child patient lies in the personality of the practitioner; the means employed take second place, for in view of the simplicity of the child mind these need not be of an elaborate or expensive nature.

A good dentist is not necessarily a good school dentist. The success of a dentist with children depends less on his degrees than on his putting his whole heart into this special work. His age matters less than his sympathy with and comprehension of the child soul.

*Reprinted from The Dental Magazine and Oral Topics, November, 1932.

Children should be prepared for dental treatment long before they actually come to the clinic, and a start should be made in the home and at school. The fight to win their confidence must be begun before they come up for treatment, and the weapons used must be such as enable us to dive into the child world and adapt our thoughts and feelings to those of our little friends.

CHILDREN AMONG CHILDREN

We must be children among children, and the things that will bring us together are games, pictures and fairy tales. These three must never be lost sight of, even during actual treatment; although in regard to home and school the dentist can only work indirectly. In this connection my little picture book entitled *Au Backe, mein Zahn** has proved very helpful and, judging from the many letters I have received from colleagues, teachers and parents, these humorous illustrated verses have brought about better results than many instructions and friendly warnings.

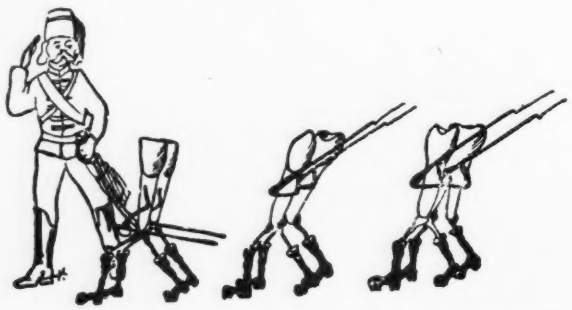


Illustration from the author's "Soldier's Song of the Teeth."

There is no doubt that a moral which appears in the guise of a fairy tale, so that the children will not realize what it is, will be taken to heart more than a lecture on how to take care of the teeth. The cleverest lecture will not impress a child nearly so much as a parody of some well-known verses or a dental adaptation of a fairy tale. The picture of the Puss in Boots who had to pull out the Queen's tooth because she had not visited the dentist regularly, will always appear before the mind's eye of the child when Puss in Boots is mentioned.

He will be reminded to have his teeth attended to twice a year because he lives in a world of make-believe and fairy tales.

A similar effect is produced by the verses about Foolish Helen, Jack and Jill, the Soldier's Song of the Teeth, and the Riddle of the Milk Tooth, which is given below as an example:

I am a great king,
In your mouth is my throne,
You know me, I think.
I am never alone.
When my work is done
And my crown without gold,
Then follows my son.

*A German slang expression used when a sudden twinge of pain is felt in a tooth.

The Bochum Clinics, which take care of the dental needs of more than forty thousand children attending elementary schools, have for years endeavored to gain the confidence of child patients in this way. During the examination of the teeth in school, when a superficial survey is made of dental defects, one or other of the poems in *Au Backe, mein Zahn* is read aloud after a preliminary lecture, and the class is presented with a copy of the book. At the conclusion of the dental treatment further copies are provided to be drawn for by the children who come to the clinic for treatment. The booklet provides the teacher with a basis for interesting and readily understood instruction.

Snow White and the Seven Dwarfs. One of the fairy stories painted by the author on the walls of the dental clinic at Bochum.

THE FIVE SENSES

As soon as the children arrive at the clinic, preliminary treatment is started in the room where their names are entered. It takes into consideration the five senses, i. e., sight, hearing, smell, taste and touch, as all these make their impression on the mind of the child. Simple and logical as this procedure is, it has frequently been ignored in the past. For instance, when a nervous patient came for dental treatment, he was ushered into what was obviously a dental waiting room, his nose was unpleasantly reminded of the smells associated with a surgery, and he heard the screams of other patients who were being hurt or thought that they were. In some cases he even had to wait in the operating room.

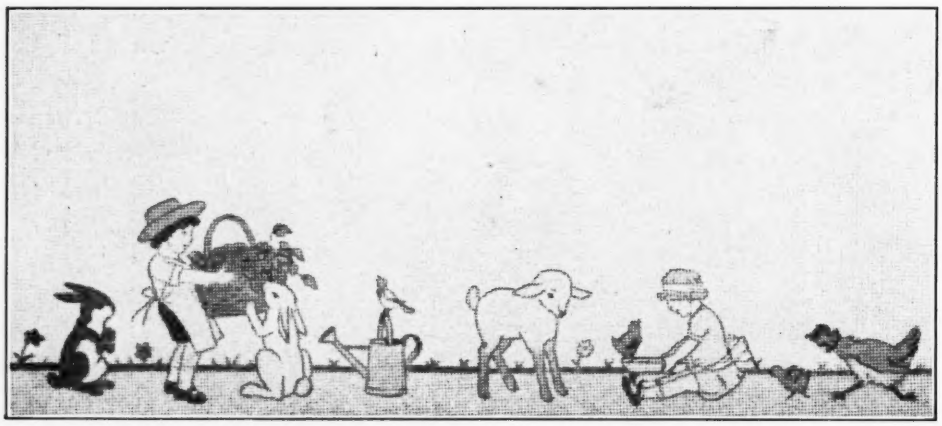
It was obvious that radical changes had to be made in this direction, and it was not only necessary that the sense should not receive disagreeable impressions, but that on the contrary they should be impressed in a way that appealed to the tastes and nature of a child.

PICTURES PAINTED ON WALLS*

First in regard to the *eye,* care had to be taken that the child's attention was not drawn to surgical objects, and that he should see only an ordinary reception room. In the waiting room, which it would be better to call a playroom, the child should be able to forget that he has come to visit the dentist. During a vacation I painted on the walls of the waiting rooms at the Bochum Clinic a series of colored pictures and verses, so that today every wall is covered with these decorations. Children see here Snow White and the Seven Dwarfs, Little Red Riding Hood, the Gnomes of Cologne, Jack and Jill, Puss in Boots, and so on. A negro shows them his snow-white teeth and says to them:

Drink milk, eat fruit and rye bread, please,
And you'll have teeth as white as these.

In this way the eye is captivated by a wealth of color, and the thoughts of the waiting patient are turned in a natural way to his own make-believe world.



Of course, fairy tales, picture books and games are laid out on the tables of our clinics.

Paintings on the walls are, however, more hygienic, as they cannot be soiled by the children; and as they can be seen by all the waiting patients at the same time, they also prove more practical.

In the summer, children who come to the clinic see other children playing in the garden, where a large box of sand is put at their disposal. The garden is fenced all around, so that the children can only get out of it by going through the clinic. Waiting in the fresh air while indulging in childish games is better than anything for the child, as his mind is entirely diverted and he comes quite fresh to the operating room.

What child patients see of the results of treatment or of the treatment itself should be as far as possible pleasing to the eye and calculated to inspire confidence. It is a good thing if the waiting rooms can be arranged in such a way as to be entirely separate one from another, so that children who have to remain at the clinic for a time after treatment can be brought into a second room where they will

*The pictures illustrating this article were all the work of the author's own brush and were painted during his vacations.

have no opportunity of talking to those who are waiting for treatment or boasting of the courage with which they have endured, or think they have endured, pain,

More interesting examples of the author's wall paintings.

for the *ear* must not receive unfavorable impressions. Our careful preliminary work would be all to no purpose if the waiting children were upset by those who had received treatment.

SOUND-PROOF OPERATING ROOM

Naturally, care must be taken to avoid noise during treatment, or at least to take care that no sounds of distress can reach the ears of the waiting children. If possible the operating room should be made sound-proof, or excitable patients should be asked to attend after the ordinary consultation hours, when they will not be able to influence others by their behavior.

The above should not be understood to imply that silence should be maintained in the waiting room; on the contrary, I think it is better for the children to be allowed to make a noise, as in this way their attention is distracted from any noise that may be made in the operating room. In the Bochum Central Clinic we have installed a radio loudspeaker, which transmits music and anything likely to interest the children and make them forget their own little troubles.

Impressions can also be made on the *nose* to induce the right attitude of mind. As already suggested, it is not desirable for the child to be able to say: "There is a smell of the dentist." If it is necessary to use disinfectants, the whole clinic need not reek of iodoform, lysoform, and the like. Efficient substitutes are available; for instance, ipsiform or sagrotan can be used instead of lysoform. If it should be necessary to use mixtures containing iodoform for root fillings, these should be stored in some other room and only brought into the operating room when needed. After use they should be removed at once, together with the instruments which have come into contact with them. It is a good plan to add odol or extract of chlorodont to the rinsing water, and to use a pine-scented soap for washing the hands.

By the use of agreeable perfumes the *taste* also is influenced—a point which has to be taken into account in treating children.

Finally, we come to the most important thing of all, i. e., *feeling,* through which the patient's fears of dental treatment may turn out to be justified. The less a nervous patient knows about an operation, the more he dreads the pain. Why do so many people, even adults, carry the burden of the fear of pain, which is sometimes entirely groundless? The reason is that they do not trust the dentist until they have satisfied themselves that he is to be trusted. In some cases, and this is especially true of children, they will trust the man in the white coat as long as he does not shake their confidence.

Therefore, if every patient trusts his dentist or doctor, and believes that he will not hurt, the most difficult psychologic problem surely is solved.

If his young patients are treated on the above principles the work of a dentist carrying on a practice for the treatment of children will be less trying than it would otherwise be, and moreover his patients will lose the fear of dental operations. To attain this end is the aim and object of school dental clinics.

THE IMPORTANCE OF THE NUTRITIONAL CONDITION IN THE DEVELOPMENT OF THE TEETH AND JAWS*

DR. PHIL. GUTTORM TOVERUD, OSLO, NORWAY
Professor of Pedodontia at Norwegian Dental School

IT HAS long been recognized that great variation exists in regard to predisposition to dental caries. Much remains to be discovered as to the causes of this difference, but beyond any question there remains the importance of the structure of the teeth. The outer formation leading either to extensive or to only small lodging-places plays just as big a part in the initiation of dental caries as does the density of the dental structure in the rate of progress of the disease.

In searching for the cause of abnormal conditions one has to go back, of course, to the development of the teeth. As we know, the deciduous teeth are all in the calcifying stage at birth, and this is also true with regard to the first molar. Therefore, in order to study conditions during the whole calcifying period of these teeth it is necessary to begin with the pregnant woman. Many authors have laid stress on the importance of nutrition during this period for the development of the teeth of the fetus, but almost all have concentrated their attention on the vitamins—some on vitamin C and others on vitamin D. We all know, however, that vitamins are only accessory food factors; they simply *help the minerals* to build the teeth. The minerals needed for the whole metabolic process must, of course, be present.

The mineral metabolism of the pregnant woman has not been the object of any extensive interest so far as can be judged from the literature. The older reports on this subject (Hoffström, Landsberg) show that the balance of Ca and P is usually positive throughout pregnancy. Attention should be drawn here, however, to the very high intake of these minerals, an intake not commonly met with nowadays. In confirmation of this, recent reports from America (McCoons, Blunt, Macy, Huncher) and from Norway (K. U. and G. Toverud) show that pregnant women living on an ordinary diet containing a rather low amount of Ca and P very often show a rather high negative balance. A few tables from the last-named publication will illustrate this. (The women in question lived on an ordinary institutional diet in a home for unmarried women; the diet was of a character common to this country, being deficient in vegetables, fruit and milk.)

From 44 metabolic experiments performed during pregnancy on 17 women living on the usual diet of the home, it was found that the balance of Ca and P was negative in the majority of cases. As far as Ca was concerned no women showed a positive balance during the last two months of pregnancy unless the Ca intake had reached 1.6 gm. per day. According to these findings an "optimum daily intake" of 1.6 gm. of Ca, and nearly 2.0 gm. of P was established for the pregnant woman. The mere addition of vitamin D to a diet highly deficient in minerals and vitamins was not sufficient to change the balance to a positive one. Only when the mineral intake was around the "optimum" and the balance was still negative, was an addi-

*Reprinted from The Dental Magazine and Oral Topics, November, 1932.

tion of 10 c.c. of a potent cod liver oil effective in giving a positive balance. This was also the case in some instances with a pure vitamin D preparation—"Vigantol."

WOMEN NO.	MONTH OF PREGNANCY	DIET	MINERALS STUDIED	INTAKE	TOTAL OUTPUT	BALANCE COUNTING FETUS
				gm.	gm.	gm.
			Ca	0.7152	0.6787	−0.4195
2	7	Ordinary	P	0.9825	1.2933	−0.5648
			Mg	0.2933	0.3050	−0.0217
			Ca	0.5819	0.7083	−0.5824
2	7½	Ordinary	P	0.6972	1.3080	−0.8648
			Mg	0.2171	0.2643	−0.0572
			Ca	0.9691	1.0000	−0.0909
5	6½	Ordinary	P	1.2632	1.0375	−0.1897
			Mg	0.3336	0.3773	−0.0457
			Ca	0.6718	0.6760	−0.4602
5	7½	Ordinary	P	1.0045	0.8250	−0.0745
			Mg	0.2704	0.1280	−0.1324

The acid-base equilibrium also seemed to play a part. A surplus of base improved the balance.

THE BEST KIND OF DIET

The kind of diet best suited to give a positive balance of Ca and P, and on the whole securing the best condition for the calcification processes, was one characterized as a lacto-ovo-vegetarian. Since the diet of the home in question has been changed to one containing about one liter of milk, plenty of vegetables, some fruit and an egg, or in the winter one tablespoon of cod liver oil, daily, all metabolic experiments have given a positive balance of Ca and P. The following are examples:

WOMEN NO.	MONTH OF PREGNANCY	DIET	MINERALS STUDIED	INTAKE	TOTAL OUTPUT	BALANCE COUNTING FETUS
				gm.	gm.	gm.
			Ca	1.625	0.987	+0.182
25	8½	Regulated	P	1.843	0.942	+0.647
		diet	Mg	0.392	0.139	+0.244
			Ca	1.827	1.324	+0.047
27	8	Regulated	P	1.923	1.082	+0.587
		diet	Mg	0.431	0.158	+0.264
			Ca	2.090	1.319	+0.315
29	8	Regulated	P	2.163	1.231	+0.678
		diet	Mg	0.504	0.285	+0.210

THE MOTHER'S MILK

The next important period to be considered is that of lactation. When the child was breast fed, it was customary in earlier days to regard the nutrition as

perfect. This *may* be the case, but is not so *always*. Many years ago Hoffmeister pointed out that there is great danger of the child getting an insufficient amount of minerals during lactation. This question is of even more interest today when we know from metabolic experiments (K. U. and G. Toverud) that unless the intake is rather high a negative balance of Ca and P may also be present during this time. The composition of the mother's milk is also dependent on the diet. Thus a distinct lowering of the mineral content may be found during a low intake, and a rise to the normal when the diet is regulated as described above.

Besides the difference in the mineral content human milk, as is very well known, differs also in vitamin content according to the diet of the mother.

The danger of a subnormal nutritional condition of the child during the first period of postnatal life is greater when the baby has to be fed on artificial food. In that event it is, no doubt, more a question of the ample amount of vitamins than special attention to the minerals (except iron), as artificial foods mainly consist of cow's milk. The rachitic condition causing faulty calcification of the teeth mostly develops during such feeding. By animal experiments it has, furthermore, been plainly demonstrated and clinically confirmed that the more deficient the diet of the mother during pregnancy, the more serious will be the pathologic condition of the infant if the postnatal feeding is also deficient.

DIET FOR CHILDREN FROM THREE TO TWELVE YEARS

In his study of mineral metabolism in children from three to twelve years of age, Jeans has come to the conclusion that a high milk diet gives the best Ca retention. The Ca in milk is better absorbed than that in fruit and vegetables. A diet containing only a pint of milk gave an average daily retention of 6 mg. per kg. body-weight, whereas a diet containing a quart of milk showed an average daily retention of 15 mg. per kg. The latter amount corresponds closely to the quantities estimated as needed by the growing frame, while the retention in a diet containing only one pint of milk is considerably lower than the calculated need.

The diet in this period should thus contain plenty of milk and, besides that, a liberal amount of vegetables and fruit, supplemented by eggs and cod liver oil. The latter food stuff—cod liver oil should be considered as such and not as a drug—should be taken especially during the winter.

In spite of the diet having been perfect, the teeth may nevertheless be of a subnormal character. Many factors may have a secondary influence on the nutritional condition: the digestion, absorption and intermediary metabolism. One of the most common factors in this connection is infection. Chronic as well as acute infections associated with rise of temperature and toxin production, will often influence the whole metabolism. Catabolic processes are accelerated, and the anabolism may be seriously affected. Clinical observations confirm this. On the other hand, it is also commonly observed that when the primary nutrition has been satisfactory, the secondary factors are likely to do less harm than when the diet has been insufficient.

THE JAWS

Nutritional conditions are also of great importance for the development of the jaws. One of the most common deformities is compression of the jaw, and this may nearly always be traced to a rachitic period. Even earlier, however, than the

time for development of the pathologic condition called rickets, the narrow jaw may be detected. Thus Kantorowicz and Korkhaus have found this condition in infants thirty-seven days old. It is improbable that a physiologic action such as sucking would affect the jaw in this way, unless the bones were subnormally calcified. Such deficient bone structure can hardly be caused by disturbance of the postnatal metabolism alone. It is more likely that an osteopathic process was present at birth, as previously demonstrated in experiments on dogs. This early abnormally soft condition of the jaw bone is perhaps comparable to craniotabes—the great softness of the cranial bones found in many infants during the first months of life, especially in premature infants. It may even be found that the normal pillowing leads to deformation of the skull. The parallelism of the conditions is rather close.

The effect of thumb-sucking is more marked in infants where an osteopathic process is present or has been present. If the nutritional condition of the infant is perfect, this habit will do little harm.

Experimental work and clinical experience point in the direction of showing that the calcification of the teeth and jaws is dependent on the pre- and postnatal nutritional condition of infants and children. By securing an optimum calcification in this way teeth and jaws will withstand any external factor in the most favorable way.

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ABSTRACTS OF
CURRENT LITERATURE

NUTRITION AND PEDIATRICS

By Samuel Adams Cohen, M.D., New York City

It is the purpose of this Journal to review so far as possible the most important literature as it appears in English and foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Ten Years at the Lymanhurst School for Tuberculous Children. J. Arthur Myers. Ann. Int. Med. **6**: 5, 1932.

The first ten years of a longitudinal study undertaken at the Lymanhurst School for Tuberculous Children is reported by Myers. In this institution children are grouped as follows: The first group are those who are negative to tuberculin test administered intracutaneously (1 milligram) and who also have no physical findings which may be due to tuberculosis. These children therefore may be classed as (1) negative to tuberculosis. The second group includes children who react positively to the tuberculin test but in whom no evidence by x-ray, physical or laboratory examinations can be obtained of tuberculous disease. This group is classified as (2) primary tuberculous infection. The third group includes children who react positively to the tuberculin test and in addition have some evidence, usually by x-ray examination of the location of the tuberculous focus or foci. Obviously these lesions need not necessarily be in the chest. The classification of this group is termed (3) childhood type of tuberculosis. The last classification is termed (4) adult type of tuberculosis. In this group are placed all of the definite clinical forms of tuberculosis regardless whether lesions appear in the lungs, bony framework or elsewhere.

Among the more important considerations regarding treatment of these children Myers (who writes from the Departments of Preventive Medicine and Internal Medicine, University of Minnesota, and the Lymanhurst School for Tuberculous Children, Minneapolis) mentions that strict attention is paid to prevention of further exposure to tuberculosis. In addition he considers close medical and nursing supervision second only to the regulation of expenditure of energy (that is regulation of games, adherence to rest hour and the like).

Myers' experiences with infants lead him to state that contrary to previous accepted belief these individuals have been found to have an excellent tolerance for tubercle bacilli. The factors which seem to determine whether these infants survive or succumb are dosage and continued exposure. Furthermore, Myers' opinion is in accord with many authorities when he states that in the diagnosis of the childhood type of tuberculosis the tuberculin test and x-ray film examination are superior to all other aids.

Endemic Typhus Fever of the United States History, Epidemiology and Mode of Transmission. R. E. Dyer, L. F. Badger, E. T. Ceder, and W. G. Workman. J. A. M. A. **99**: 10, 1932.

These authorities point out that epidemic typhus is known to have existed in Europe and in Asia for many centuries as a disease of the lower strata of society often afflicting great numbers of people in times of economic stress. Its high degree of communicability can be readily grasped when it is noted that during the epidemic in Serbia in 1915 the mortality among physicians in attendance in cases of typhus amounted to 36 per cent. Experimental and clinical evidence of epidemic typhus is overwhelmingly convincing that the transmission of epidemic typhus is by means of the body louse.

Epidemic typhus was present in Mexico shortly after the Spanish Conquest; that is to say, Mexican epidemic typhus was present perhaps in 1526 but was surely evident in 1570. Although there have been various instances when epidemic typhus has been introduced into the United States, the disease, as is known in this form, apparently never gained a permanent lodging in that country.

Regarding endemic typhus the excellent work of Brill who in 1898 published a study of 17 cases of a disease occurring in New York City clinically resembling typhoid fever but without the Widal reaction is of interest. In 1910 and again in 1911 Brill reported additional cases of this disease, and it was recognized by him that the clinical entity described was in reality typhus fever, but his laboratory and clinical experimentations led him to state that some agent other than the body louse must be looked for to explain the origin of *this* form of typhus, which is sometimes known as Brill's disease.

From this time on much evidence has been gradually accumulated to show that what is now known as endemic typhus, or Brill's disease, can be carried by the rat flea. Moreover the organism responsible for the endemic typhus can remain virulent in the affected rat flea for at least fifty-two days after the last infected feeding. It is interesting to note also that the endemic typhus organism may be kept alive in nature by the rat louse as well as by rat fleas.

These authors who as officers in the United States Public Health Service have made many notable contributions to the mode of transmission and epidemiology of typhus state "it would appear definitely established that the disease typhus has two manifestations known at present: the first and better known, a louse-borne disease of great communicability from person to person in times of overcrowding of unclean populations and characterized by its tendency to the formation of epidemics; the second, a disease primarily of rodents which is apparently transmitted from rat to man by rat fleas. This manifestation of typhus seemingly is not transmitted from man to man and is therefore characterized by the tendency to remain endemic."

Congenital Heart Disease With Special Reference to Its Etiology. Samuel Adams Cohen. Med. Clin. North America **15**: 5, 1932.

The author considers Maud E. Abbott's clinical classification of congenital cardiac defects most satisfactory for clinical study. Abbott divides cases of congenital heart disease into three groups: (1) those patients who have no cyanosis; (2) those patients who are potentially cyanotic, that is they may develop a

transient or terminal cyanosis; and (3) those patients who are cyanotic at birth or who become cyanotic soon after.

Cohen states that the etiology of congenital heart disease falls into three main groups: (1) fetal endocarditis, (2) persistence of conditions in the individual which are normal in fetal circulation, and (3) defective development.

The article emphasizes that developmental defects of other organs or tissues which accompany congenital cardiac disease may result from the same underlying etiologic factors. This is readily observed in cases of Mongolian idiocy which may have in addition congenital heart disease and also in cases of cleft palate in whom sometimes are noted the coexistence of other congenital anomalies, particularly in the visceral organs.

In regard to developmental defects Cohen points out that the formation of the parts and organs of the embryo is practically complete before the end of the second month of intrauterine life. Therefore the question as to whether there will be any developmental cardiovascular defects or for that matter any other developmental defects is practically determined by the end of the second month in utero.

Developmental defects of the embryo may result from improper conditions locally for the fertilized ovum and also as a result of abnormal constitutional conditions affecting the fertility of one or both parties. For example endometritis may cause a faulty implantation of the fertilized ovum which in turn may so alter its environmental factors that the ovum's natural growth and nutrition are liable to be interfered with to the end that the developmental defects may result, and abortion or miscarriage usually takes place under these circumstances.

Fertility and conditioned sterility are a variable stage depending naturally on the constitution and compatibility of both partners. Diminished fertility (and even sterility) is liable to result when either one or both partners have some constitutional disturbance, as for example, obesity, malnutrition or other nutritional disturbances, anemia, syphilis, tuberculosis, thyroid insufficiency, marked exhaustion and also mental worries. Now if under these unfavorable circumstances conception does take place, faulty development of the embryo may follow, and this usually leads to abortion or miscarriage—since nature tends to rid itself of imperfect products of conception before term. Obviously the many exceptions to the rule are liable to show some developmental defects at birth.

With these thoughts in mind Cohen mentions that the prophylaxis treatment of cardiovascular developmental defects or for that matter any other congenital anomaly consists in the main of eliminating as much as practical all these local and constitutional factors of one or both parties which unfavorably influence fertility.

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EDITORIALS

A Big New Move for Dentistry

INTEREST in children's dentistry is growing rapidly. Its development is closely paralleling that of pediatrics. It took medicine a long time to awaken to the fact that real preventive medicine began with the unborn child and not with the diseased adult. This same truth is beginning to dawn upon dentistry. Just as medicine at last realized that a strong, healthy, virile nation depended upon healthy, properly developed children and speeded up interest in pediatrics, until all physicians are now pediatrics-minded; so will dentistry in the not distant future realize that preventive dentistry starts with the child, until dentists become child-dentistry-minded.

What is the most scientific, the most fascinating department of dentistry? What department is most generally appreciated and well regarded by the laity? THE INTERNATIONAL JOURNAL OF ORTHODONTIA AND DENTISTRY FOR CHILDREN is in a position to know that, at least in the large cities, it is the specialty of orthodontia. There are several obvious reasons why orthodontia has become so well regarded by the laity in general, first and probably foremost being that the pioneer workers in this practice put their very hearts and souls into developing the science, and within the short span of the last thirty years orthodontia has taken a position of merit probably second to none in either medicine or dentistry. What is more satisfactory and what is more appreciated than a complex case of malocclusion successfully corrected by modern methods? The public appreciates this kind of service. Second, orthodontic service has been directed largely toward children, and there is nothing which attracts so much attention or is so greatly appreciated by the public as creditable physical improvement made for a little child. Dentistry for children is now in the identical position in its process of evolution before the public as were the science and the practice of orthodontia thirty years ago (a neglected stepchild, so to speak), which now promises, however, with the proper interest behind it to be the greatest and most important field from the standpoint of merit that the dental profession has to develop within itself, a field which up to this time has never been properly appreciated or appraised.

This is no time for the time-worn alibi that the public does not appreciate children's dentistry and that the dental profession is not educated to the importance of it. The time is here when children's dentistry will be appreciated in proportion to the amount of educational work behind it, and depending largely upon whether or not the dental profession is able to grasp the big idea behind the move.

In this period of evolution in dentistry, a period that means much to the dentist who realizes its importance and accordingly puts his house in order, what are the problems involved at this time?

First, the dentist who prepares for the coming of this new era must broaden his vision. He must realize that dentistry means more than mechanical repair or the replacement of tissue destroyed; the vision is greater than that. He must visualize the denture development of the unborn child. He must understand that upon the chemical balance of the mother's blood depends the ultimate structure of the teeth of the child. He must do his bit in cooperation with the physician to make certain that the mother understands this principle and eats food that supplies the needed calcium and phosphorus to give the unborn child the proper tooth structure. He must get the pediatrician's viewpoint of children and associate this with the development of the dentition.

Second, he must educate the child's parents along lines of preventive child dentistry. He must become a crusader in this cause. He must have so clear an understanding of the health and the economic value to the child of sound, healthy teeth and believe so sincerely in this that his sincerity will convince the mother and secure her perfect cooperation in this cause.

Third, he must perfect himself in the technic of handling children. In order to do this he must have a perfect understanding of child psychology and child

behavior. The dentist who shirks his responsibility to children and hides behind the cloak that dentistry for children is too irksome should give up the practice of dentistry. A physician is as much justified in refusing to treat a child because the child may cry or protest during the treatment as is a dentist in ignoring the child's need for dental service because the child may cry. To win the child is part of the job in hand. Child psychology is a most important study for the dentist. It unfolds possibilities little dreamed of until they are understood, and once understood and applied in the handling of children one of the greatest obstacles to the practice of children's dentistry is removed.

Fourth, a keen imagination is an essential quality in the dentist practicing children's dentistry. He should be able to present an accurate picture for the mother of what the results may be if a pinpoint cavity is neglected in the deciduous teeth. He should be able to show the mother and illustrate the malocclusion that may result if deciduous teeth are lost and not replaced by the proper technic. He should know the mortality rate of rheumatism and heart disease in children, diseases induced and aggravated by decayed teeth and pus. Such pictures are not exaggerated, and the dentist should be able to explain these facts to the mothers who are his patients.

Fifth, the principles of mouth hygiene must be thoroughly understood and applied in office examinations and treatment and the mother instructed in just how these methods are to be carried out in the home, and just how important they are to the child.

Sixth, the technic of operative treatment must be sound and in line with the most approved modern methods.

Seventh, it is well for the dentist that he look upon children's dentistry as a possible solution for many of the economic ills that beset dentistry today. It affords an opportunity to increase practice, to employ hours profitably that would otherwise be wasted, and to make dentistry more important in the public eye. Two hours a day used in caring for children who need dental supervision will add a great deal to the dentist's income. This time would possibly be wasted; however, employed in caring for children, it becomes an added source of income.

Children's dentistry offers possibilities as great as those offered by pediatrics. It is a department of dentistry that can be practiced more intensely by any dentist with his present office and equipment if his practice in this field is not large enough to warrant specially equipped rooms. The satisfaction derived from such service is most gratifying.

Visualize then a condition something like this: an era in which there shall be much less pulpitis and pain, afflictions suffered by the child and ultimately by the adult; a time when malocclusion will be more rare because children's mouths will be supervised, checked and double-checked during development, and defects arrested in their incipiency. There will be fewer wrecked and mutilated mouths, only those caused by the infirmities and decay of old age; a time when rheumatism and heart disease in children resulting from mouth infections will disappear, and to many this will be the most important field which dentistry can possibly serve, but up to this time it has been very much neglected. Picture, furthermore, a time when the physician and dentist will cooperate whole-heartedly to see that the pregnant woman is so cared for and her nutrition so care-

fully supervised that when the child is born the tooth buds are equipped with the proper chemical balance, and this continued cooperation between the physician and dentist will make it possible for the child to grow to healthy and wholesome manhood or womanhood, largely because it has escaped the dangers and diseases that result from faulty dentition and the ever prevalent septic mouth diseases so characteristic of childhood.

This picture is not too far-fetched. Dentistry has a broader and greater field in the problem of dentistry for children than it has ever realized heretofore, and the surface has not been even scratched. The actual prevention of disease, which we now know is possible by the proper supervision of children's mouths, is very important; and it only remains for the dentist himself along with the layman to realize its full significance, then it can and will become the most appreciated and scientific department of dental practice.

THE INTERNATIONAL JOURNAL OF ORTHODONTIA AND DENTISTRY FOR CHILDREN dedicates itself from this time onward to making such a dream come true and invites the cooperation of every dentist in the world who is trying to create a better and healthier childhood by giving better dental care to children. The child of today is the man or woman of tomorrow.

H. C. P.

1933 Versus 1915

JANUARY is our birthday month—eighteen years ago this Journal was born. Like the pioneer, its life has been a continual struggle; and like the pioneer it looks with confidence to the future, believing now as it did eighteen years ago that the chief concern of scientific dentistry is prevention rather than cure, and close cooperation rather than indifference between physician and dentist.

Medicine and dentistry were crude sciences when this Journal was born compared with their refinement of today. Since 1915 the teaching of the art and science of dentistry as well as its practice has undergone radical changes.

In 1915 students were matriculated in dental schools with little regard for their fitness for a professional career. Proprietary dental schools were flourishing in almost every state. Territory was divided between these schools, students were allotted to them, and deans fought for student patronage. Boys were taken from shops, farms, and factories without even a high school education, and in three years were graduated as full-fledged dentists. The postgraduate course was flourishing at that time like a green bay tree. The local anesthetist, the pyorrhea specialist, the dental economist, the prosthodontist with a pet articulator sponsored by an enterprising manufacturer, were clamoring for the attention of every local and state society. These blind leaders of the blind were promising, for a price, to make trained specialists of student practitioners within a week's time. In many cases dental manufacturers sponsored such courses for the sole purpose of selling expensive and in many cases useless equipment. Advertisements were accepted in dental journals that were an insult to even a puerile intelligence.

This Journal believed eighteen years ago as it believes now that dentistry is a learned profession; that while its field is much more restricted than that of medicine, it is just as important for a dental student to be carefully trained as for a medical student. It believed then as it believes now that dental manufacturers should serve dentistry and not that dentistry should serve the manufacturers.

It raised its voice eighteen years ago for the child who needed orthodontic service. It believed then as it does now that orthodontic service should be available to children, but by competent operators. It believed then as it does now that orthodontic treatment should be a part of the service rendered by the dental profession. It felt eighteen years ago as it feels now that the care of the child should be the chief concern of both dentist and physician.

Since 1915 this Journal has lived to see great changes take place in dental and economic affairs. It has seen a complete change in dental education. It has seen the economic world soar to dizzy heights of prosperity and then plunge to almost unbelievable depths of economic despair. It has seen the map of Europe remade and the diadems of the Romanovs and Hohenzollerns literally cast into the dust. It has seen a complete revolution in the attitude of both the dental and the medical professions toward child life. In recognition of this change, with this issue the

Journal changes its name. The departments of Oral Surgery and Radiography will be dropped, but a very complete department of Dentistry for Children will be added, and the name will be changed to THE INTERNATIONAL JOURNAL OF ORTHODONTIA AND DENTISTRY FOR CHILDREN.

"It is possible," says the dentist to the mother, "to rear your child to adult life with perfect occlusion and without the child's ever having a toothache, but you must put this child under a dentist's care when he is two years old and let the dentist see him four times each year." "It is possible," says the physician to the mother, "for you to rear your child without his ever having infectious diseases such as measles, whooping cough, mumps, or scarlet fever, but you must keep your child away from sources of infection and keep up his resistance." How different from the old days when the dentist said, "Let the deciduous teeth decay and be lost as quickly as possible. They do not mean anything, and Nature wants to get rid of them as soon as she can." And the physician said to the mother, "Let your child be exposed to measles and other childhood diseases as soon as possible and get it over with."

Yesterday the physician thought that obstetrics meant seeing the mother through the confinement period only. Today good obstetrics means taking care of the mother throughout the period of pregnancy. Rickets, the scourge of childhood, is being conquered during intrauterine life by having the mother eat food that gives her blood the proper chemical balance so that calcium and phosphorus are available in proper amounts for the bone cells of the fetus. The dentist must cooperate with the physician in giving this advice because the tooth bud with a proper chemical balance in the cell must be fed from the mother's blood that is itself in proper chemical balance, so far as calcium and phosphorus content is concerned.

In the Department of Dentistry for Children subjects such as nutrition and growth, endocrinology, psychology and behavior, as well as operative technic and economics, will be covered by specialists in these fields. A far cry you say from the dentistry of 1915. Yes, it is. But it is the culmination of a vision painted when the first issue of this Journal saw the light of day eighteen years ago. There is still much to be done. The surface has not been scratched. Dentists must be still better trained. They must be encouraged to read more, to study more, to think more, and to serve better. Dental groups and dental clinics, even orthodontia in capable hands, must be encouraged, and closer cooperation between physician and dentist must be established if there is to be rapid progress.

C. V. M.

IN MEMORIAM

DR. H. F. STURDEVANT

1878-1932

THE Pacific Coast Society and the American Society of Orthodontists have lost a beloved and loyal member in the passing of Dr. H. F. Sturdevant on September 27 at his home in Santa Monica, California. To those of us who were privileged to know him his death has left a feeling of irreparable loss which is eased,

H. F. STURDEVANT
1878-1932

however, by the cherished memory of the man who was an aggressive orthodontist, a devoted husband and an honest and intelligent citizen; one who demanded more of himself than he was physically able to give, faced life courageously and kept his spirit serene even through trouble and pain.

Dr. Sturdevant was born December 5, 1878, at Box Elder, Colorado. He attended the Colorado Agricultural College at Fort Collins, Colorado, from where he graduated in 1901. He then took up the study of dentistry at Ann Arbor, Michigan, and later at the University of California at Berkeley.

After graduation in 1905 he went to The Dalles, Oregon, and was associated with Dr. A. S. Essen in the practice of general dentistry for six years, at which time he went to New London, Conn., where he took his special work in orthodontia under Dr. Edward H. Angle. He returned to Portland in 1912 and married Miss Harriet M. Longmire of The Dalles.

He continued the practice of orthodontia in Portland, and in 1916 a partnership was formed with Dr. W. R. Dinham, then of Portland, which resulted in a most enjoyable mutual arrangement until 1923 when he was forced to discontinue his practice because of ill health. Then, in 1925 he went to Florida, finally opening an office in Orlando where he practiced for two years and a half, when he came west again and in August, 1930, resumed his practice at Santa Monica, where he continued until his death.

Dr. Sturdevant was a member of Delta Sigma Delta, the Masonic Order, and the Rotary Club.

NEWS AND NOTES

American Society of Orthodontists, Thirty-Second Annual Meeting, April 19, 20, and 21, 1933, Oklahoma City, Oklahoma

It seems especially fitting to hold the next annual meeting of the American Society of Orthodontists in the home of the president in the great southwest. General plans for the meeting have been completed, and everything indicates that it will be an extraordinary session. The progressive pioneer spirit of the southwest has strongly manifested itself in the dental and medical professions. Oklahoma especially has attracted national attention with the numerous outstanding achievements of these organized professions.

Medical Arts Building, Oklahoma City.

The dental profession in particular can point with pride to its many accomplishments.

Oklahoma is credited with having first introduced and proved the value of intensive courses of postgraduate study under the management of the dental society. It was the first state to provide the short itinerant courses of special instruction through the Extension Division of the University of Oklahoma. They have operated regularly each year for the past several years. For the past two years it has had the advantages of a state appropriation for special dental education. It has made possible a very broad and comprehensive course of dental economics featuring office surveys and dealing with almost all the allied subjects, such as insurance, in-

Osler Building, Oklahoma City.

Crippled Children's Hospital, Oklahoma City.

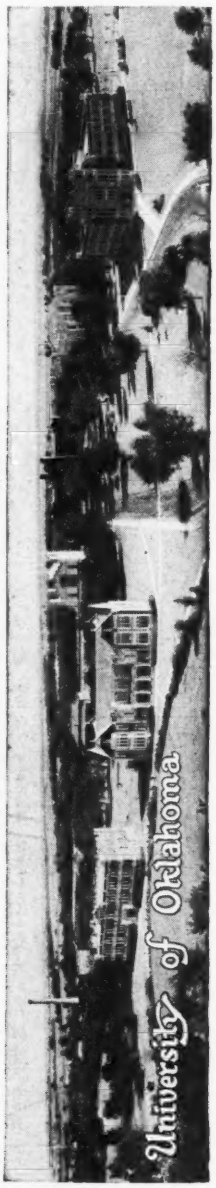
vestments, salesmanship, et cetera. Naturally, Oklahoma City, as the capital located in the center of the state, and with the great state university located in a suburb, has become the center of medicodental education.

The Oklahoma City Clinical Society of the medical organization conducts a postgraduate course of instruction every fall embracing all the major branches of medicine. Leading teachers and research workers from all parts of the United States and some foreign countries are brought to Oklahoma City to fit into the general educational program. This course of instruction attracts physicians from many of the neighboring states.

Oklahoma City can boast a fine fraternal spirit, as it has more than its share of out-

standing energetic professional men who have provided all the educational and clinical facilities that are necessary to maintain the highest standard of public health service.

Among the many things to which Oklahoma City could point with pride as a medical and dental health center is the Medical Arts Building, one of the first to be constructed in the southwest. It was made possible through the cooperation of one of the principal banks and the professions. By a horizontal division of ownership the Physicians and Dentists



Building Corporation obtained use of one of the city's best office building sites without rent by building the outside walls and roughing in the interior of the basement and two lower floors. The bank holds ownership to the lots and ground section equivalent to two stories in height. The Physicians and Dentists Building Corporation owns the building from the second floor up. Each pays its separate taxes and directs the management of each section independent of the other by a working agreement. The building was so designed and equipped as to meet the special requirements of the professions.

This business venture not only has made medical and dental service more convenient for the public seeking services but has brought the professions in closer relation and proved to be a real financial success. The guiding spirit and the business genius back of the project was a local physician.

Another fine medicodental building is located about a mile from the business district in a community trade center. The building is named in memory of the famous physician Dr. Osler, and as the name would indicate it is occupied exclusively by outstanding physicians and dentists. The building is U-shaped and six stories high with all special equipment for medical tenants. The lobby and corridor floors are of terrazzo, with terrazzo base with walls of rough tinted plaster. A rather unusual feature is that there is no rentable space sit-

Medical and Dental Arts Building, Tulsa.

uated more than twelve feet from outside light. The building is managed and financed by a closed corporation of several physicians.

Tulsa, which is known as the oil capital and noted for its tall and beautiful office buildings, has one of the most attractive Medical Arts Buildings in the United States. It is a great monument and tribute to dentistry, as full credit for the erection of this great structure was due to the business acumen and the fine professional and civic spirit of a dentist.

Oklahoma fully recognizes its responsibilities to the crippled children. Oklahoma was one of the first to develop a crippled children's society. It was sponsored and promoted by the Oklahoma City Rotary Club. This organization is now one of the most active and efficient crippled children's societies in the United States. It was mainly through the influence of sentiment fostered by this organization the large Crippled Children's Hospital was established in connection with the State University Hospital and Medical School.

In the Children's Hospital a dental hygienist sees every child as soon after admission as

its condition permits. She instructs the child in better mouth hygiene in combination with prophylactic services. Caries and other dental conditions if present are recorded and such dental services rendered as conditions indicate.

Orthodontia has been a crying need in this institution. About two years ago the dental staff secured permission to develop a dental orthopedic department. It was planned to begin in a very modest way and to be consolidated as it developed rather than to make mistakes by going too fast. It is being conducted by a former dental interne who is well qualified for the undertaking. If the hopes of the dental staff can be realized, this will gradually develop into a service which will reflect credit to orthodontia.

These hospitals are partly supported by state funds. Nearly all patients are charity or county patients. The individual neglect of their dental health requirements makes the need of dental attention very great.

The University Hospital and the Hospital for Crippled Children can care for about 500 patients. They are full at all times, and usually there is a waiting list of several hundred. They are managed by the University Medical School and are used as teaching institutions.

All dental services in the hospitals and elective lecture courses on dental subjects are conducted by a dental staff of four Oklahoma City dentists who divide their time; one staff

Oklahoma University Medical School.

man going to the hospital every day for consultations and to direct the work at hand. In cases of jaw fractures and other complicated conditions other than ordinary dental routine he does the work himself or is present to direct it. A full time dental interne takes care of both hospitals and out patients. The service is limited to hygienic dental treatment.

A cordial spirit of cooperation prevails between the dental and other staffs to relieve patients with dental conditions which may have been the cause or a factor in their illness. The dental interne is assisted in prophylactic work by the dental hygienist from the Crippled Children's Hospital when her time permits.

The University Medical School is housed in a fine new structure designed for the sole purpose of meeting all the special requirements of medical education. It has a Class A rating and is recognized as one of the best medical schools in the country. Applications for admission are greater each year than the budget and facilities can handle. The number of students is therefore limited to about seventy-five new students each year. Special regulations dealing with the aptitude and general qualifications of the applicant as set up by the American Medical Association are used in selecting the medical students. Over three hundred usually apply for admission each year.

Oklahoma holds the distinction of being one of the very few states in the country that has a state orthodontia society. It and the Southwestern Society of Orthodontists invite you to come to Oklahoma City for the meeting of the American Society of Orthodontists. We promise to make it a visit you will never forget.

LOCAL ARRANGEMENTS COMMITTEE:

T. W. SORRELS, Chairman
W. E. FLESHER
J. N. BOLTE
H. H. SORRELS
WM. E. OVERMEYER
R. C. MEYER
OREN H. MCCARTY
E. F. WOODRING
E. B. STRICKLER
C. D. STRICKLER
M. W. MURRAY

El Paso, Texas—Carlsbad Caverns National Park

TWO EXCELLENT STOP-OVER POINTS ENROUTE TO THE ANNUAL MEETING OF THE AMERICAN SOCIETY OF ORTHODONTISTS

Those living along the Pacific Coast or in the far southwest will find the route through El Paso, Texas, one of the most interesting ones to the annual meeting at Oklahoma City. There

The Scenic Drive above El Paso. This mountain drive cuts across the nose of Mount Franklin, and from the highest point on it the city may be seen spreading out around three sides of the mountain. Old Mexico, New Mexico, and Texas are visible from this point.

are three places on this trip that you will especially enjoy—El Paso, its sister city of Juarez, Chihuahua, Mexico, and the Carlsbad Caverns National Park.

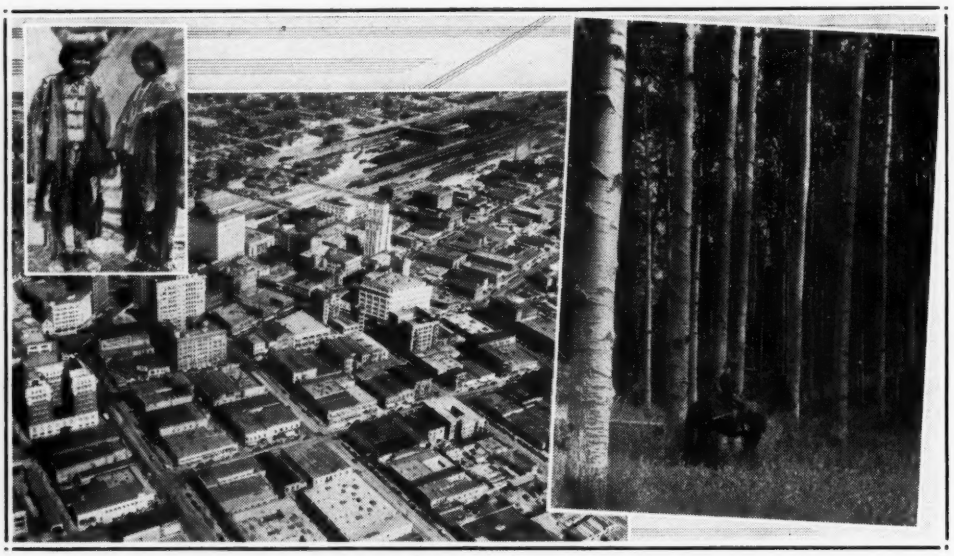
Whether you make the journey by railway, by automobile or by airplane, you will find this route the ideal one to Oklahoma City.

El Paso is the largest American city along the United States-Mexican frontier, and Juarez is the largest Mexican city. Only the historic Rio Grande separates the two. Transcontinental railways, highways and airways connect El Paso with the rest of the nation. These various transportation facilities converge at El Paso to take advantage of the lowest and most easily traversed pass in the Rocky Mountains—El Paso del Norte, from which the city gets its name.

In the fertile valleys above and below the cities are thousands of acres of rich, irrigated farm land, the water for this project coming from Elephant Butte Dam, one hundred and thirty miles north in New Mexico on the Rio Grande. From the highest point on Scenic Drive, a mountain road across Mount Franklin and just above the city, one has a wonderful panorama of desert plains, mesa lands and green valleys, with mountain peaks cutting the horizon on every hand. New Mexico, Texas, and old Mexico are to be seen from this one point.

Places of interest in El Paso include Fort Bliss, largest cavalry post of the United States army, the home of the Second Cavalry Brigade of the First Cavalry Division, and division headquarters; the Texas College of Mines and Metallurgy, the smelter and refinery districts.

For those of you who have time to spend a few days in El Paso, either going to or coming from the convention, there are many delightful drives that may be taken into West Texas and New Mexico. The Lincoln National Forest, the Mescalero Apache Indian Reservation, the White Sands of Alamogordo, the Gila National Forest nearby, and the Davis Mountains of west Texas are all of interest. Other places nearby that may be visited within a short time include the Hueco Tanks, an old Indian rendezvous, and the old missions in the valley below El Paso.



El Paso from the air. Upper left, two Apache Indian belles of the Mescalero Apache Indian Reservation. Upper right, in the Lincoln National Forest.

Mission of Nuestra Senora de Guadalupe, Juarez, Mexico. Built in 1659, this old mission, which is just across the Rio Grande from El Paso, is still in daily use.

Juarez, Mexico, but a few minutes away by street car or motor, is well worth a visit. This is Mexico's largest port of entry along the United States border. The old mission, the bull ring, the brewery garden, and the many modern cafes offer a variety of attractions for the visitor.

The trip to Carlsbad Caverns National Park is to be recommended most highly. This visit can be made in a one-day round trip from El Paso, or for those who are traveling by automobile, it may be visited after leaving El Paso for Oklahoma City. Words cannot begin to describe the magnificence of these gigantic caves, and their many curious and beautiful formations. Electrically lighted, and with daily elevator service for those who desire, the Carlsbad Caverns may be visited in comfort. The temperature is comfortable and the trails are easily followed. No special

clothing is required to make the trip through them, but it is advisable for women to wear low-heeled shoes. Lunch is served 700 feet below the surface of the earth. The Big Room is amazingly large, being nearly three-quarters of a mile long and about 600 feet wide, with a ceiling so high that it is lost in the gloom and darkness above.

But you should see it for yourselves. It is a trip that you will never forget.

El Paso is ready to welcome you. Organize a party and come this way and enjoy every part of your trip. For further information write Dr. W. T. Chapman, First National Bank Building, El Paso, Texas.

Chicago—Host City of Centennial Dental Congress—a Dental Center

Chicago, host city for the Centennial Dental Congress which includes the Diamond Jubilee of the American Dental Association, has valid claim to the title of America's leading dental center. Out-of-town visitors to the Congress will have ample opportunity to convince themselves of this fact during the week of August 7-12, 1933, when the Congress will be in session at the Stevens Hotel.

Chicago is the home of the American Dental Association. In May, 1931, the Association acquired its own home located at 212 E. Superior Street. In it are housed all the central activities such as the secretary's office, library bureau, bureau of chemistry, council on dental therapeutics, etc. The American Dental Association will hold open house during the week of the Congress in order that every visitor may be privileged to see the Association at work in its own splendid facilities.

As many thousands of dentists throughout the world who received their dental education in Chicago well know, this city has some of the leading dental colleges of the country, viz., Chicago College of Dental Surgery, Dental Department of Loyola University, the University of Illinois College of Dentistry and the Northwestern University Dental School. Their combined alumni form a very substantial portion of the world's dental population. To many, the week in Chicago during the Congress will be an unusually attractive homecoming. Among the 15,000 dentists who are expected to attend the Congress will be many former classmates and friends of most practicing dentists. What an opportunity for a reunion!

Another claim of Chicago that merits mention is the fact that this city is annual host to the Midwinter Meeting of the Chicago Dental Society. Within the past decade the reputation of this meeting has spread to every nook and cranny of the country so that it now occupies an enviable position among dental meetings. The Chicago Dental Society, sponsor of the Congress, is the largest local dental society in the world.

In dentistry's Hall of Fame we come upon the names of many Chicagoans who have helped make dental history: W. W. Allport, G. V. Black, Truman W. Brophy, Galvin S. Case, George H. Cushing, T. L. Gilmer, Hart J. Goslee, L. P. Haskell, Edmund Noyes, J. H. Prothero, C. P. Pruyn; and many others could be enumerated if space permitted. Certainly this is a roster of which Chicago may well be proud.

Yes, the host city for the Congress is a dental center. All the dental organizations and institutions in Chicago have been planning for months to make the Congress and the Diamond Jubilee of the American Dental Association the outstanding dental meeting of all time. Members of the Association are not only cordially invited, but urged to attend this meeting which will be held in conjunction with A Century of Progress Exposition.

Washington University Dental Alumni Association's Annual Meeting

The annual meeting of the Washington University Dental Alumni Association will be held at the Washington University Dental School, St. Louis, Mo., February 20, 21, 22.

Lectures will be given by the following members of the faculty: Doctors E. P. Brady, Virgil Loeb, L. H. Jorstad, Edgar Keys, Wm. G. Becke, Robert Mueller, Clarence Simpson, H. C. Pollock.

In addition to the above lectures the following men will give special courses: Dr. George Winter in exodontia, Dr. A. P. O'Hare in prosthesis, and Dr. Max Kornfeld in metallurgy.

No charge will be made for these courses.

LEO M. SHANLEY, Secretary,
4482 Washington Avenue,
St. Louis, Mo.

St. Louis University Dental Alumni Reunion

Following the custom of the past few years, the members of the alumni of the St. Louis University School of Dentistry will again feature lectures and clinics at their annual reunion.

The lectures and clinics will be illustrated with interesting specimens and slides, and will be given by well known and prominent alumni.

The meeting this year will be held in the St. Louis University Gymnasium on Friday, March 31, and Saturday, April 1.

Thomas P. Hinman Midwinter Clinic

The annual Thomas P. Hinman Midwinter Clinic will be held Monday and Tuesday, March 13 and 14, at the Atlanta Biltmore Hotel, Atlanta, Ga.

The Great Lakes Association of Orthodontists

The annual meeting of the Great Lakes Association of Orthodontists will be held in Cleveland, Ohio, February 27 and 28, 1933.

A cordial invitation is extended to all ethical practitioners of dentistry and orthodontia to attend this meeting.

RALPH P. HOWARTH, Secretary-Treasurer,
1140 Hanna Building,
Cleveland, Ohio.

Dental Society of the State of New York—Preliminary Program

The Dental Society of the State of New York will hold its sixty-fifth annual meeting in Syracuse, New York, May 11, 12 and 13, 1933. Literary exercises, exhibits, etc., will be held at the Hotel Syracuse. Harvey J. Burkhart, 800 E. Main St., Rochester, N. Y., is chairman of the Program Committee; Emory Thompson, 333 Linwood Ave., Buffalo, N. Y., chairman of the Clinic Committee, and Thomas R. Cullen, Oswego, N. Y., is chairman of the Exhibits Committee. The Executive Council will convene for the transaction of the business of the Society Wednesday, May 10, at 8 P.M.

The essayists are: I. Lester Furnas, Cleveland, Ohio; John Scholten and Harry E. Hanson of Cedar Rapids, Iowa; P. G. Puterbaugh, Chicago, Ill.; Walter Chappelle, Buffalo, N. Y.; Arthur B. Gabel, Philadelphia, Pa.; James E. Aiguier, Philadelphia, Pa., and Chalmers J. Lyons of Ann Arbor, Mich.

During the time of the meeting, sessions of the New York State Dental Hygienists' Association and the Dental Assistants' Association will be held.

Headquarters will be at the Hotel Syracuse, and reservations should be made direct with the hotel management.

For information with reference to the literary exercises, clinics, etc., apply to:

A. P. BURKHART, Secretary,
57 E. Genesee St.,
Auburn, N. Y.

Illinois State Dental Society

The sixty-ninth annual meeting of the Illinois State Dental Society will be held at Peoria, Ill., May 9, 10, 11.

A. B. PATTERSON, President,
406 Morris Building,
Joliet, Illinois.
BEN H. SHERRARD, Secretary,
300 Rock Island Bank Building,
Rock Island, Illinois.

North Carolina Dental Society

The fifty-ninth annual meeting of the North Carolina Dental Society will be held at the University of North Carolina, Chaptel Hill, June 6, 7, and 8. All members of the American Dental Association are cordially invited.

D. L. PRIDGEN, Secretary-Treasurer,
Fayetteville, N. C.

New York Society of Orthodontists

The annual meeting of the New York Society of Orthodontists will be held at the Hotel Waldorf Astoria, New York City, on Monday and Tuesday, March 13 and 14. The opening session Monday will begin at 9:30 A.M. An exceptionally valuable program has been arranged. All interested physicians and dentists are cordially invited to attend.

LOWRIE J. PORTER, President,
730 Fifth Avenue,
New York, N. Y.
FRANKLIN A. SQUIRES, Secretary-Treasurer,
Medical Centre,
White Plains, N. Y.

The American Society for the Advancement of General Anesthesia in Dentistry

The next meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held at the Barbizon-Plaza Hotel, New York City, on Tuesday evening, February 28, beginning with a dinner at 7 P.M. The scientific session will start at 8:15 P.M.

The speaker will be T. Drysdale Buchanan, M.D., New York City. His subject will be "A Critical Survey and Personal Observations of Emergency Measures Available in General Anesthesias."

M. HILLEL FELDMAN, President,
730 Fifth Avenue,
New York, N. Y.
LEONARD S. MORVAY, Secretary,
76 Clinton Avenue,
Newark, N. J.
JAMES TAYLOE GWATHMEY, Honorary President,
133 E. 58th Street,
New York, N. Y.

American Society of Stomatologists

The tenth anniversary meeting of the stomatologic movement in America by the American Society of Stomatologists and its affiliated societies will be held at the Hotel McAlpin, New York City, on Thursday and Friday, April 27 and 28. The following sessions will be held:

1. General Session: Thursday evening, April 27, 8:30 P.M., for the presentation of the scientific program and reports. The educational report will also deal with "The Transitory Stomatologic Program" as it concerns recent dental graduates and practicing dentists; the needed expansion of hospital and postgraduate teaching facilities for dentists; and the present needs of educational and legal recognition of the dental qualification.

2. Executive session: Friday morning, April 28, 10 A.M.

3. Stomatologic clinics: Friday afternoon, April 28, 2 P.M. The general session will be preceded by an informal dinner at the Hotel McAlpin to which members of the professions and their guests are welcome. Those wishing to participate in clinics, discussions, etc., and to attend the dinner will please communicate with Dr. Irene G. Woodcock, Chairman, Local Arrangements Committee, Wickersham Professional Building, 133 East 58th Street, New York City.

For further particulars address the secretary of the Society.

DR. LLOYD L. BAKER, President,
DR. ALFRED J. ASGIS, Secretary,
310 West 72nd Street,
New York, N. Y.

Items of Interest

Dr. Willard A. Gray announces the removal of his offices to 611 Medical Arts Building, Rochester, N. Y. Practice limited to orthodontia.

Dr. Leonard M. Gunton, associated with the late Dr. William C. Fisher, announces the continuance of his practice, 501 Fifth Avenue, New York, N. Y. Practice limited to orthodontia.

Dr. L. E. Habegger will continue the practice of the late Dr. H. F. Sturdevant. Offices at 300 Central Tower Building, Santa Monica, Calif.